Federation of Rhodesia and Nyasaland

REPORT

of the

SECRETARY

to the

FEDERAL MINISTRY OF AGRICULTURE

For the Year Ended 30th September, 1960

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1961

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(which includes the Departments of Research and Specialist Services, Conservation and Extension Services, Veterinary Services, and Tsetse and Trypanosomiasis Control and Reclamation)

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REPORT OF THE SECRETARY TO THE FEDERAL MINISTRY OF AGRICULTURE

C. A. MURRAY, *Secretary for Agriculture*

By the end of 1959 the real national income of most of the major industrial countries of the world had increased substantially by comparison with the position at the beginning of that year and the world seemed set for a long period of growing trade unhampered by financial difficulties such as declining external reserves and inflation, so predominant an influence in the recent past. In primary producing countries the revival in economic activity was less marked but most experienced an improvement in their terms of trade and in the demand for their products. This favourable economic climate continued up to the beginning of the final quarter of 1960.

In the international field the Federation has continued to be much concerned with the operations of the European Common Market, particularly in relation to its effects on our exports. Concern over tobacco has loomed large in this connection, and during the year the Minister of Agriculture and the Minister of Economic Affairs as well as the Under Secretary, Economics and Markets, made visits to the capitals of the Common Market countries and to Geneva for the purposes of discussions.

During the year also the Federation became an Associate Member of the Food and Agriculture Organization and the Under Secretary, Economics and Markets, attended a conference in Madrid called to deal with the production and marketing of citrus fruit, and the annual conference of the Committee on Commodity Problems held in Rome.

POSITION OF AGRICULTURE IN THE FEDERATION

Notwithstanding the continuing and encouraging development of manufacturing industries and mining, agriculture is still the dominant industry in the Federation. Over vastly the greater part of the country it is the only industry. About four-fifths of the people are either employed in agriculture or engaged in agriculture on their own account.

In 1959 the gross value of agricultural production, including African rural consumption which is not marketed, was £106.3 million. Of this, tobacco accounted for £29.8 million; maize, £25.7 million; slaughter cattle, £11.3 million; dairy produce and groundnuts, just under £6 million each, and tea £3.3 million.

The gross value of other industries for 1958 (the latest year available) was:

Mining and quarrying	£102 million
Manufacturing industries	£133 million
Building and civil engineering ...	£69 million
Electricity and water	£10 million

Total marketed sales of agricultural products in the Federation in 1959 were:

Maize	624,100 short tons
Groundnuts	26,460 short tons
Cotton	11,313 short tons
Flue-cured tobacco	195,230,000 lb.
Other tobacco	36,350,000 lb.
Tea	26,436,000 lb.
Slaughter cattle	402,251 cattle
Pigs for slaughter	152,670 pigs
Milk	18,400,000 gallons

The 1959/60 growing season was marred by drought in some parts of the Federation, and maize production fell. Final figures for 1960 are not yet available, but such is the strength and buoyancy of agriculture that, despite the drought, production of tobacco reached a new record with sales of 110,000 tons of flue-cured and 18,300 tons of other tobaccos; milk production rose to 20 million gallons; cattle slaughterings to over 420,000 head; and pig slaughterings rose slightly. Other products such as groundnuts, cotton, and, it is expected, soya beans are on the threshold of big expansion developments.

Of particular importance in the past year has been a drop in the price of fertilizers.

The prospects for agriculture in 1961—and thereafter—remain good. The population of the Federation is doubling itself every 25 years and wage levels continue to rise, thereby raising the internal demand for food. But at the same time agricultural production will also grow and it can be expected that there will be increased exports of tobacco, tea, cattle and groundnuts.

CROP PRODUCTION

Federal Grain Marketing

The Grain Marketing Board's programme of integration of the Northern and Southern Rhodesian marketing systems continued and the area of control is becoming more and more one unit. During the year, the Cotton Industries Board's assets were disposed of to private enterprise and the Grain Marketing Board was required to handle the crop on behalf of producers.

The issue of free grain bags under the Maize Price Agreement continued with the Grain Marketing Board responsible for their distribution in Northern Rhodesia, and the trade in Southern Rhodesia. The system, in general, worked well, although certain concerns in Southern Rhodesia suffered losses, especially in so far as the smaller African traders were concerned, as many, probably through ignorance, did not return the bags issued to them.

Preliminary discussions were held regarding the extension of the Maize Price Agreement and it has been suggested that instead of a free bag issue, it might be preferable to add the cost of the bag plus a small handling margin on to the assessed price of maize. The question of the reserve stocks was also considered during the year and it is hoped to amend the Agreement to bring the form of replenishment of reserve stocks into line with actual practice.

Maize

Southern Rhodesia. The acreage of maize planted by Europeans in the 1958/59 season was almost the same as that of the 1957/58 season (348,880 acres and 349,270 acres respectively). Total production was 3,826,600 bags compared with 3,589,600 in 1957/58. The yield per acre improved from 10.3 bags to 11 bags per acre, and was the highest in the history of the Colony. The 1959/60 crop of 366,000 acres was adversely affected by drought in many areas and yields fell well below 1958/59 figures to an average of 8½ bags per acre. Total intake up to the middle of November, 1960, by the Grain Marketing Board (in both Northern and Southern Rhodesia) was 3,864,209 bags of white maize and 87,928 bags of yellow maize. This included deliveries by Africans.

Northern Rhodesia. The 1958/59 maize crop in Northern Rhodesia showed a very considerable improvement over the disastrous 1957/58 season and the yield per acre, at 10.3 bags, was almost double the 5.6 bags of 1957/58. A total of 109,200 acres yielded 1,119,500 bags. African deliveries to the Board also improved to a more normal level.

The Northern Rhodesian Ministry of African Agriculture assumed responsibility for the buying services which have been previously operated by the Grain Marketing Board within the native areas themselves. Arrangements are also being made to extend, where practicable, the privilege of delivering maize direct to the Board. There is now no uniform transport deduction from the African maize price and the deduction is now at a level calculated according to the distance of the buying point from the line of rail, subject to a maximum deduction equivalent to a charge for 66 miles.

Prices. The producer prices for Class "A" maize was fixed at 36s. in terms of the Maize Price Agreement for the 1959/60 crop as it was calculated that no exports would take place. The selling price was 41s. 9d., Southern Rhodesia, and 41s., Northern Rhodesia. A third payment was made for the 1958/59 maize crop and this brought the final price for "A" grade maize to 38s. 4¾d. and in Southern Rhodesia to 36s. 3½d. per bag.

Rhodesia Seed Maize Association. The total area sown for hybrid seed production during the past season was 4,400 acres. Of this acreage 4,200 acres have produced seed for sale. This is 450 acres more than the previous year. Already 72,000 100-lb. pockets have been sold this season; this is 5,000 pockets more than were sold in the previous season and 28,000 pockets more than were sold in the 1956 season. These figures give a very clear indication how the demand for hybrid seed continues to increase in the Federation.

SMALL GRAINS

(a) *Kaffir Corn and Munga.* These two grains continued to be handled by the Federal Grain Marketing Board. The price of Class "A" munga was fixed at 33s. 6d. per bag for the 1959/60 crop and the Grain Marketing Board's selling price was 40s. 9d. To encourage the local production of named varieties of kaffir corn suitable for brewing purposes, a new Class "S" grade was introduced and the price of this was fixed at 40s. Class "A" kaffir corn was priced at 37s. 6d. The Grain Marketing Board's selling price of malting kaffir corn was 50s., and stockfeed quality 40s. The drought severely affected munga supplies, which were insufficient to meet the demand and a rationing scheme was in operation for most of the year.

This was most unfortunate for the pig industry, which has come to recognise the value of munga as a highly suitable pig food, but it was essential to reserve the small available supplies for certain drought stricken Native reserves. There was an increasing demand for high grade malting kaffir corn and as in previous years it was necessary to import considerable quantities to meet the requirements of this market. The Federal Ministry of Agriculture has since launched a drive to increase the production of malting grade kaffir corn up to the limit of market requirements, and preliminary indications are that there has been an encouraging response.

(b) *Rupoko.* The producer price of rupoko was maintained at 33s. 6d. so as to maintain intake at a low level until the embarrassing stocks had been cleared. The selling price was also kept at 47s. 6d. with a rebate down to 40s. when used for stockfeed purposes. During the year there was a gratifying reduction in stocks and it appears likely that all old stock will be cleared by the middle of 1961.

BEANS

The marketing of beans was not subject to Government control, and the Grain Marketing Board does not handle the crop. Imports which were necessary were handled by the trade. There is a world trade in many varieties of edible beans, but it appears that at present the difficulties of production limit the possibilities of the Federation entering significantly into this export trade.

WHEAT

Summer Wheat. There has been no increase in acreage of this crop. Varieties are available which give fair yields during summer if kept free of weeds but the weed problem still remains the greatest obstacle in the successful production of wheat. New trials with a live mulch are being tried out this year in an attempt to overcome this problem. The production of wheat on any worthwhile scale in the Federation during the summer months is not considered good.

Winter Wheat. Winter wheat production continues to decline. Only 6,700 bags were produced during the 1959 season. This is 3,800 bags less than in the 1958 season and 8,641 bags less than in the 1956 season, and about one-tenth of the production of the best years during the last war.

GROUNDNUTS

As in the previous year the 1959/60 crop was disappointingly small and imports were again necessary. The Grain Marketing Board's intake of shelled nuts from the 1959/60 crop (up to mid-November, 1960) was 184,527 bags, together with 1,140 bags of unshelled nuts. In addition imports of groundnuts from outside the Federation were almost 94,000 bags for the six months to the end of October, 1960.

The final estimate of sales of African produced groundnuts from the Southern Rhodesia 1960 harvest was 65,000 bags and purchases of African groundnuts in Northern Rhodesia (up to the middle of November) were:

	bags
Eastern Province	106,649
Central and Western Province	1,190
North Western Province	4,817
Southern Province	376

Disposals of the Eastern Province crop by the Eastern Province Co-operative Marketing Union were as follows:

	long tons
Graded confectionery	810
Screened "A" confectionery	815
F.A.Q. confectionery	4,848
Mixed to Grain Marketing Board, Lusaka	1,718
Rejects, milling nuts	91
Local and seed	149
Losses	152
TOTAL	8,583

In order to encourage increased production of groundnuts a new classification Class "S" of nuts intended for export has been introduced. Producers are paid a preliminary 100s. per bag for this grade and additional payment will be made if export realization, less costs, exceeds this figure. Class "A" groundnuts were priced at 90s. and the Grain Marketing Board selling price was raised from 89s. to 101s. per bag in July, 1960. The reason for this steep increase was the necessity to import large quantities at high prices.

Imports of groundnuts into Northern and Southern Rhodesia for the expressing trade are currently running at about £1 million a year, and it is evident that there is great scope for increased production. In order to encourage this a pre-planting price for the 1960/61 crop was announced in August, 1960. In addition, intensive efforts are being made to inform producers of the latest techniques of production, Mr. Sellschop, of the College of Agriculture and Research Institute, Potchefstroom, toured the Federation during April and May to advise on groundnut production.

RICE

The Nyasaland rice crop again fell short of the Federation's requirements and imports continued to be necessary. This is a great disappointment as all evidence indicates that, given settled political conditions, Nyasaland could easily supply the Federal market requirements. The price paid for Nyasaland rice is a generous one, well above import parity, and well-established marketing facilities exist to take up the Nyasaland crop.

POTATOES

The over-production of potatoes which characterized 1959 carried on until January, 1960. The country then experienced the usual slight seasonal shortage and imports were necessary for a few weeks. Potatoes continued to be scarce and of variable quality until the end of the rains. Supplies were adequate during April but there was another period of scarcity in May between crops—again necessitating imports. The first irrigated crop was smaller than that of the previous year and potatoes were again short during September and October. The Union of South Africa was unable to meet our full requirements and prices rose.

The only restraints on prices during the year have been the Ministry's import control under which imports can be allowed in whenever local prices rise above 10s. and exports take place when prices fall below 9s. In general, the system has worked well although retail prices, especially on the Copperbelt, were often higher than appeared to be strictly justified. Producers also found it difficult to find export outlets when supplies were heavy, but towards the end of the year the landed price of imports was high and local producers with potatoes available had no difficulty in obtaining considerably more than 10s. per bag.

During the year the Minister agreed to examine the possibility of a potato marketing board for Northern Rhodesia. The Committee under the Under-Secretary (Economics and Markets) and representatives of all interests was formed for this purpose and recommended that a board be introduced for that territory. This matter is still under consideration.

FRUIT

When the new Union Trade Agreement came into force on the 1st July, 1960, the import controls on fruit were extended and import permits are now required for:

Apples imported during the months of January, February, March or April.

Citrus fruit imported during the months of June, July, August, September, October or November.

Grapes imported during the month of December.
Peaches imported during the month of January.
Plums imported during the months of November and December.

The 1959/60 crops of plums and apples were disposed of satisfactorily. The plum crop was badly affected by hail and imports were necessary during the second half of December.

The apple crop again showed an increase in size and was sufficient to meet the bulk of the country's requirements from the middle of February onwards.

A continued increase in the processing of fruit and vegetables took place at the Umtali and Cashel factories. Improved means of transportation were also available.

While there was a reduction in the number of new citrus plantings by farmers, many additional orange trees were planted at Mazoe Citrus Estates, being the commencement of a greatly extended scheme for an increase in orange juice concentrate.

No marked increase in other sub-tropical fruit plantings occurred. More deciduous fruit trees and grapes were established. Improvements in orchard management continued.

It is believed that the time has come when it may be necessary for Government to assist growers of deciduous fruit with the orderly marketing of their crops.

VEGETABLES

Commencing on the 1st January, 1960, an import tariff of 1d. per lb. on imported vegetables, which will remain in force for two years, was introduced. This protection has reduced very considerably the volume of imports of vegetables into Southern Rhodesia, although considerable quantities are still being sold in Bulawayo. In the first nine months of 1959 Federal imports of vegetables totalled 1,517 tons valued at £40,133; for the corresponding period in 1960 these imports fell to 817 tons valued at £25,492. The figures for both years exclude potatoes and onions.

Supplies of vegetables throughout the year appear to have been reasonably adequate, although Bulawayo still relies considerably on imported produce.

The new Union Trade Agreement extended the period of permit control on onions to include August. This assisted in the disposal of the local crop as merchants were unable to stockpile during that month.

TOBACCO

The 1959/60 season South Western flue-cured tobacco crop was another record one with a total weight sold by auction of 217,867,339 lb. and a total value of £31,012,466. This was an increase of £3½ million on the previous season's receipts. The average price of 34.16d. was almost the same as that of 1958/59 season (34.44d.).

Registered growers numbered 3,099 and, of these, 2,924 sold tobacco. These growers declared a total crop of 212,153 acres which was an average of 72.56 acres per grower—again almost identical with the previous season's 72.87. The average yield per acre rose by 141 lb. to 1,027 lb.—the first time the country's average has exceeded 1,000 lb. per acre. This was an excellent result, especially as the season was a difficult one.

The North Eastern Rhodesia flue-cured tobacco crop showed little change compared with 1958/59. Production was 1,605,740 lb. compared with 1,682,000 lb. in 1958/59. Total receipts for the crop were £196,644 16s. 2d.—an increase of nearly £20,000 over 1958/59. The acreage decreased by 350 acres to 1,950 acres, giving an average yield of 823 lb. per acre. The average price per lb. was 29.39d. Both yield per acre and average price, although well below those obtained in the South Western areas, represented a very appreciable improvement over the results obtained by the Fort Jameson area in previous years. Thirty-eight growers were registered and 31 actually sold tobacco. The 1959/60 crop was the last one to be sold on the Salisbury auction floors as it is intended that in future all tobacco produced in this area will be sold at Limbe. The new Tobacco Marketing Act will come into force on the 1st January, 1961, with separate marketing boards for the South Western and North Eastern areas. Nyasaland and the North Eastern Province of Northern Rhodesia will both be included in the North Eastern area. All types of tobacco will be covered by the new legislation.

North Eastern flue-cured tobacco continued to be subsidized to equate the price received for the different grades with those ruling for the equivalent South Western tobacco. This subsidy in 1960 totalled £33,489 14s. In addition, growers in the area received a subsidy on transport costs of fertilizer which amounted to £2,250 16s. 3d.

No fire-cured tobacco was sold on the Salisbury auction floors. What little was produced was consigned directly by the growers to merchants.

Sales on the Limbe floors of the different types of tobacco for the season were:

Sun-cured	6,969,830 lb. at 19.14d.
Burley	2,920,830 lb. at 32.72d.

In addition 225,318 lb. of North Eastern Rhodesia sun-cured tobacco was sold at an average of 16.86d. and 636,178 lb. of North Eastern Rhodesia Burley at an average of 33.90d. per lb.

Production of Turkish tobacco showed a striking increase and estimates reveal the following production.

			lb.
Southern Rhodesia:	Europeans—	Soulouk	1,005,180
		Samsun	400,750
	Africans—	Soulouk	240,000
		Samsun	400,000
Northern Rhodesia:	Europeans—	Soulouk	142,672
		Samsun	1,500
	Africans—	Soulouk	65,500
		Samsun	131,600
Nyasaland		... ...	22,000

In the Rhodesias 848 European growers were registered and 4,427 Africans. The Central African Turkish Tobacco Growers' Association was formed during the year.

The United Kingdom continued to be the major market for our tobacco. Declarations of purchases indicate that half the crop is purchased for that market.

Buyers' Declarations of Destination of Purchases

	lb.	%
South Western Area —		
United Kingdom	109,038,983	50·05
Australia	10,715,634	4·92
Local Market	8,087,114	3·71
Other Markets	90,022,540	41·32
Unallocated	3,068	—
TOTAL	217,867,339	100·00
North Eastern Area —		
United Kingdom	957,078	59·61
Australia	39,634	2·47
Local Market	14,338	0·89
Other Markets	594,566	37·03
Unallocated	124	—
TOTAL	1,605,740	100·00

The Tobacco Export Promotion Council of Rhodesia and Nyasaland has continued its task of pushing the sales of Federal tobacco actively throughout the year.

PASTORAL PRODUCTION

CATTLE

The season was one of severe drought in Matabeleland and parts of the Midland area. Emergency measures were necessary and a Drought Relief Committee was quickly set up. The Cold Storage Commission also co-operated and cattle were placed on grazier agreements with producers in Mashonaland and Northern Rhodesia. In addition, ranches near Bulawayo were able to send their cattle to areas in the Gwaai district where grazing was available on Crown land. The Grain Marketing Board purchased, on behalf of the Government, considerable quantities of hay from the less affected districts and this was supplied to farmers in Matabeleland at subsidized prices. The African-owned cattle were also seriously affected by the drought, and during the first nine months of 1960 approximately 94,000 head were sold on Native Department sales from the drought areas. There can be no doubt that certain ranchers were hard hit because of the season but in some cases this was probably aggravated by over-stocking.

Considerable interest has developed in beef production all over the country due mainly to the development of the export market in the United Kingdom and the realization that beef production offers a profitable and reliable alternative to other less stable agricultural commodities. This interest was further stimulated by an extensive campaign for improved methods of breeding, feeding and management. A special Beef Production Drive Committee was formed during the year to consider and recommend practical methods of increasing beef production for both the local and export markets. The first result of their deliberations was the completion of details for a new feeder scheme. The committee also provides for close liaison between all interested parties in the industry, which is bound to ensure effective implementation of properly co-ordinated action for the development of production schemes.

The Cold Storage Commission commenced operations in Northern Rhodesia on the 1st January, 1960, the Commission taking over the assets of the wholesale business of Messrs. Werner & Co. Grading of beef was introduced almost immediately in Livingstone and Lusaka and it was intended to extend this to the Copperbelt towns later in 1960 as staff became available. Producers in Northern Rhodesia are now able to sell the top grades of cattle on the hook at the gazetted prices, but in order to preserve the facilities they enjoyed formerly live-weight prices for cattle up to grade "A" have also been gazetted. The Cold Storage Commission buys live-weight by weight and grade along the line of rail. At the end of the year under review active consideration was being given by the Cold Storage Commission to extending its buying activities into the Eastern Province.

Arrangements are being made by the Ministry of African Agriculture to hold weight and grade sales to encourage Africans to market their cattle, and at the end of the year arrangements for the resumption of cattle sales in Barotseland with the Commission as the buyer were well advanced.

The Cold Storage Commission also started operations in Nyasaland, at the request of the Nyasaland Government. The new abattoir built by the Commission at Blantyre-Limbe came into operation towards the end of 1959. This has been very successful, and of great service to the community. However, many butchers still prefer to buy their own slaughter cattle, and about half the through-put at the abattoir consists of service slaughterings.

Producer prices fixed in terms of the Price Agreement remained unaltered during the year, although minor changes in definition of grades and the seasonal adjustment of prices were introduced in April, 1960.

A major feature of the cattle industry has been the continued drive to increase production, both for the home and export markets. In particular, the export of high quality chilled beef to the United Kingdom is receiving every attention. It is essential for this trade to succeed that a reasonable continuity of supply be maintained, and that shipping space is made available. Unfortunately during the early part of 1960 insufficient numbers of carcasses suitable for export as chilled beef were presented, while during August to November there was a surplus. Steps to ensure a more even flow of this type of cattle are again under discussion; at the same time it must be remembered that a part of this difficulty arose as a consequence of the drought. Meanwhile further discussions are continuing with the Union Government authorities and with the shipping lines with a view to the regular provision of more chilled space.

PIGS

Pig production remained at the same level and all the requirements of the country were met, while small quantities of special products were exported. Increased pig production depends largely on expansion in local demand as export possibilities under present conditions are not attractive. On the 1st January, 1960, the Cold Storage Commission took over Neill's Bacon Factory, Lusaka, and leased it to Colcom Products Ltd. Sales of pigs by Africans continue to be a feature in Matabeleland and there is a keen demand for these pigs by butchers, while Colcom is also interested in their pigs for manufacturing purposes.

The producer price control on the lowest grades of pigs became unworkable, and accordingly the price order was amended in June to remove the maximum producer price on Grade X and Inferior pigs. Retail price control on these grades was retained, though at a higher level.

During the year a new Pig Industry Act came into force which extended the operations of the Pig Industry Board into Northern Rhodesia. Later, at the request of the Nyasaland Government, a start was made on extending the Act to Nyasaland.

SHEEP

A satisfactory expansion in sheep production was recorded. Interest in sheep production is particularly evident in the more intensive areas of the country. In order to stimulate the production of high quality mutton and lamb a grading system for sheep was introduced but without any minimum producer prices, which will be determined by consultation between producers and the Cold Storage Commission.

DAIRYING

It is self-evident that the present trend of production and whole-milk consumption must lead to a continuing drop in the average price paid to producers. Already the price level is claimed by many producers to be uneconomic. It is clear that under our conditions there can be little prospect of increases in subsidy nor of consumer prices, and the only hope for increased prosperity for the producers lies in an increased consumption of whole-milk. Europeans already consume close on one pint a day, and judging from standards elsewhere there can be no hope of any large increase on that figure. But sales to Africans are still minimal, and it is in an increase in these sales that there lies the best prospects for the dairy industry. Of course, not only will producers benefit, but the Africans will also benefit very materially because of the high nutritional value of milk.

All sectors of the industry are very well aware of this, and at the close of the year under report a new drive was being launched into ways and means of increasing sales of milk to Africans.

An important development during the year was the decision of the Co-operative Creameries of Northern Rhodesia to ask that the Federal Government take over responsibility for milk marketing in Northern Rhodesia, as it already does in Southern Rhodesia. This request was accepted in principle by the Federal Government, subject to agreement on the financial implications. That matter is still under discussion.

The new dairy at Salisbury was completed and came into operation in April, 1960. This dairy was built to cater for expansion in liquid milk sales but manufacturing facilities were not built as it was anticipated that the Nestlés dried milk factory would absorb all milk surplus to liquid requirements. Provision was made in planning of the dairy for expansion to include manufacturing facilities when necessary. As milk production has increased more than was expected and the Board has taken over the creamery in Salisbury, it is necessary to carry out this expansion now so that all manufacturing activities in Salisbury are carried out on one site.

In order to assist producers in areas affected by drought a special subsidy was paid on milk supplied by them to the Dairy Marketing Board during January and February, which amounted to about 5d. per gallon.

Southern Rhodesia.

The past year saw drought conditions prevailing over large sectors of the country. Producers in Matabeleland and around Gatooma were specially hard hit and specific drought relief was given to milk producers in these areas. Milk production, however, did not appear to suffer under these conditions and rose from 12,379,054 gallons to 13,815,170 gallons, an increase of 11.2 per cent. Intake exceeded a million gallons in all months.

Whole-milk sales for the first time for a number of years showed a decrease which can largely be accounted for by consumer resistance to the increased retail prices that came into force in June, 1959. Apart from September, 1960, by which time sales had more or less reached pre-price increase levels, sales were well down on the previous year's levels. Sales fell from 7,348,096 gallons to 7,178,388 gallons, or 2.3 per cent. Milk surplus to whole-milk requirements rose to 6,636,782 gallons, which represented 48 per cent. of total production. Cheese production was the main outlet, 3,100,684 gallons being converted in this manner. This was followed by skim-milk powder production which utilized

1,802,054 gallons. Other by-products included butterfat, cream, ice-cream, sterilized milk and whole-milk exports to Portuguese East Africa.

During the year the new long-term Milk Price Agreement with the Rhodesia National Farmers' Union was extended for a further year to the 31st March, 1963. The agreement provides that cost changes need not automatically be passed on to the producer price. In the first year of the agreement costs rose by 1.1 per cent. but this was not passed on. Cost changes this year show a further rise of 1.3 per cent.

During the period under review the system of differential prices remained in force. The guaranteed producer prices for all milk sold as whole-milk plus a safety margin of 62,500 gallons per month were 51d. per gallon for the months July-November; 37d. per gallon for the period December-February and 47d. per gallon for the months March-June. Milk in excess of whole-milk sales plus the safety margin is paid for at its net realization value of approximately 21d. per gallon. The actual net realization value is calculated by the Dairy Marketing Board at the end of its financial year, namely 30th June, and if it is found that a higher realization figure than 21d per gallon could have been paid producers receive the difference as a supplementary pay-out.

Monthly pay-outs in Southern Rhodesia were:

		Guaranteed Basic Price per gallon	*Actual Pay-out Price per gallon*
1959 —	October	51.0d.	39.8d.
	November	51.0d.	39.1d.
	December	37.0d.	28.9d.
1960 —	January	37.0d.	28.6d.
	February	37.0d.	29.2d.
	March	47.0d.	35.5d.
	April	47.0d.	36.1d.
	May	47.0d.	35.5d.
	June	47.0d.	36.3d.
	July	51.0d.	38.8d.
	August	51.0d.	38.5d.
	September	51.0d.	38.3d.

The weighted pay-out price to producers was approximately 35.2d. per gallon which compares with the guaranteed basic price per gallon of approximately 46.5d. per gallon.

The final pay-out figures shown may be subject to alteration after the actual net realization value for surplus milk has been calculated. In addition to the above prices producers also received on average a payment of approximately 1.4d. per gallon under the quality premium scheme.

Retail prices for whole-milk remained unchanged and the levy imposed on producer-retailers, namely 1d. per pint on whole-milk sales within price controlled areas, remained in force.

Cheese production continued to expand and was sufficient to supply the local market with requirements of cheddar and gouda types without resort to imports. During the year exports of cheddar and gouda cheese to the Union totalled 422 tons and small amounts were sent to neighbouring countries and Nyasaland. Local production of cheese amounted to approximately 3,183,000 lb. Imports of cheese consisted solely of exotic types and processed cheese.

Wholesale and retail prices of the locally produced cheese remained unchanged during the year.

The Gazaland Co-operative Cheese Factory Ltd. continued operations during the year, but the Italo Rhodesia Cheese Factory Ltd. ceased production in September, 1959. The special subsidy payable to the former factory continued.

A further substantial outlet for surplus milk is the production of skim-milk powder, which amounted to over 1½ million pounds during the year. This powder was all of the roller process, but it is expected that before the end of 1960 a spray-drying plant will also be installed. It is expected that local production of these two types of powder will be sufficient to meet local requirements.

Building operations commenced during the year on the erection of a dried milk factory for the international firm of Nestlés. It is expected that this factory will commence operations by December, 1960. This factory will concern itself at first mainly with the manufacture of whole-milk spray-dried powder. Minimum requirements of milk will be 1.2 million gallons with a maximum of 2 million gallons.

Sales of fresh skim- and lacto skim-milk showed a marked increase and amounted to approximately 800,000 gallons. The entry of J. Lyons and Co. into the sphere of ice-cream manufacture also took place during the year.

With the increased separation of milk for the manufacture of the various by-products local butterfat production showed a marked increase. Approximately 2,354,000 lb. of butter were produced compared with 1,881,000 lb. in 1958/59. Consumption of butter tended to fall, one cause of which was the increase of 5d. a lb. in retail prices from January, 1960, coupled with the availability of margarine and margarine/butter compounds. Imports of butter were still necessary and importations into Southern Rhodesia from South Africa were made.

New butterfat prices were introduced in January, 1960, which had the effect of decreasing the difference between seasonal winter and summer prices while maintaining the same annual average price to creameries. At the same time butterfat prices in Northern and Southern Rhodesia were brought into line. No other producer price changes were made during the year and the milk producer price agreement was extended for a further year. Due to a substantial increase in world butter prices and the consequential increase in prices quoted for imported butter, it was necessary to increase the local selling price of butter by 5d. per lb. to 4s. 1d. per lb. in January, 1960. Retail prices for milk and cheese remained the same as for the previous year.

Apart from the firm of Hodgson & Myburgh in Umtali all butter manufacture in Southern Rhodesia is carried out by the Dairy Marketing Board.

The Dairy Bonus Scheme continued in operation. This scheme applies to supplies of milk to the Chipinga cheese factory and to approved suppliers of butterfat to creameries.

Modifications have been made to other dairies under the control of the Dairy Marketing Board, the object of which in the main being towards furthering the sales of milk and milk by-products to the Africans. Increased sales of dairy products to Africans has been given high priority by the Board.

With the opening of the new dairy in Salisbury the separate processing and marketing of "Channel Island" milk on behalf of the private company formed by Channel Island Milk Producers was undertaken. Sales of this milk which retails at 9d. per pint got off to a good start.

During the year distribution of milk was taken over by the Dairy Marketing Board in Umtali. Previously the service had been undertaken by the firm of Hodgson & Myburgh. In addition steps were taken for the introduction of a token system in addition to the cash system, for the purchase of milk. This service will not, however, be introduced in all centres at the start.

Northern Rhodesia

Milk production in Northern Rhodesia has continued to increase and deliveries to the Co-operative Creameries of Northern Rhodesia rose by 7.3 per cent. to 3,076,070 gallons. In addition, the intake of the Zambezi Co-operative Dairies, Livingstone, increased by 12.3 per cent. to 182,869 gallons. Producer-retailers, who are in very active competition with the creameries on the Copperbelt, have also increased their sales. This results in lower producer price pay-outs to creamery suppliers.

The pay-out prices received by producers supplying the creameries were lower this year than last. The level was 35.58 pence per gallon but no direct comparison with the previous year's average can be made as the system of pricing changed on the 1st January, 1959.

Monthly pay-outs in Northern Rhodesia were:

		Guaranteed Basic Price per gallon	*Actual Pay-out Price per gallon*
1959 —	October	51.0d.	42.05d.
	November	51.0d.	41.21d.
	December	37.0d.	26.55d.
1960 —	January	37.0d.	28.30d.
	February	37.0d.	28.07d.
	March	47.0d.	35.70d.
	April	47.0d.	36.17d.
	May	47.0d.	37.18d.
	June	47.0d.	36.30d.
	July	51.0d.	39.89d.
	August	51.0d.	38.37d.
	September	51.0d.	40.25d.

The sales campaign launched by the Co-operative Creameries has not had much noticeable effect despite considerable expenditure on advertising and the employment of several specially engaged salesmen. Total sales of whole-milk to the end of September, 1960, were 1,711,000 gallons compared to 1,656,000 gallons to the same date in 1959—an increase of only 3.3 per cent.

POULTRY AND EGGS

Production of poultry for the table continued to expand during the year and all local requirements were met. In addition, exports to the Congo increased. This was in addition to the traditional traffic in African produced live fowls.

Eggs were also in adequate supply throughout most of the year, the average producer price for standard size eggs being approximately 6d. per dozen lower than in the previous year.

The price of poultry continues to be high in this country by comparison with prices in most other countries, despite the fact that the cost of feeding stuffs is comparable. Further, the Federation is one of the very few countries in the world where top quality beef is cheaper per lb. than poultry. There can be little doubt that far more poultry could be sold if the price to the consumer was lower, with a consequent benefit to the producers through increased turnover as well as to consumers. Some move took place in this direction this year with prices being on average 6d. per lb. less than the year before.

RESEARCH STATIONS

Research has continued at an even pace, and although financial restrictions have meant some curtailment of essential expansion the stations have been able to concentrate on important problems with very little loss of momentum.

The Grasslands Research Station, Marandellas, continued to concentrate on experiments designed to assist in the development of a system of ley farming, and over 70 of these, involving some 3,300 plots and some 120 animal periods, were carried out. Increased effort has been devoted to solving the difficulties involved in the satisfactory production of legumes on sandveld. The first of the station's long-term experiments with leys was test cropped during the year but the vagaries of the past season have obscured the results to some extent.

Rain came late and in comparatively small amounts to the Henderson Research Station enabling it to demonstrate clearly that within limits high plant populations and fertilizer usage can increase drought resistance. The emphasis in research on this station has been changed somewhat in the face of growing surpluses and the need to concentrate rather on lowering costs of production. Work to this end is being directed along orthodox lines of reducing overheads, wages and other charges, and on the 300-acre unit a determined effort is being made to find a profit in milk worth 1s. 9d. a gallon, and in maize worth 20s. a bag. The river which for the past eight years has provided ample water for all requirements fell very low this year and water shortage seriously interfered with fisheries, agronomy and unit research programmes.

At the Matopos Research Station the worst cropping season in some years caused 27 projects to fail completely, six others had to be saved by supplementary irrigation and seven were successful without additional water. The information gained in this type of season was most useful, particularly on plant populations, soil moisture and growth analysis studies. In spite of the short and low rainfall high populations and fertilizer on the granite sand gave good responses; silage crops yielded satisfactorily and hay crops, when early planted were not disappointing.

Work continued on groundnuts, potatoes and lucerne under irrigation and the maize and sorghum breeding programmes.

Since Matabeleland is predominantly suited to the rearing of cattle for beef and since the arable potential of this area is very limited in relation to its carrying capacity large-scale experiments are in progress on Matopos Research Station to determine to what extent beef production can be increased through selective breeding under varying planes of nutrition.

These studies have now been in progress since 1957 and from the results obtained so far it is becoming increasingly clear that if beef production is to be increased in the marginal rainfall areas much more attention should be given to the progeny testing of beef bulls.

From a nutritional point of view it has been shown that production can nearly be doubled by feeding protein rich feeds in winter, but since protein feeds are scarce intensive studies are in progress to determine to what extent the utilization of such feeds for cattle and sheep can be improved through feeding different minerals in combination with various vitamins when animals are kept free of internal parasites.

In the field of pasture research particularly valuable results have been achieved, this being the driest season since the drought of 1946/47. The two major points brought out have been the value of a correct stocking rate and the very strong competition that exists between bush and grass.

The plant succession experiments show that the heavy soils (particularly the red soils at Matopos and Nyamandhlovu) are extremely sensitive to heavy grazing or to continual summer grazing, but that sandier soils are very resistant to mismanagement of this nature.

Good responses have again been obtained to the application of nitrogenous fertilizer to veld, in spite of the unfavourable season.

A mineral feeding trial at Nyamandhlovu has had to be discontinued owing to lack of grazing brought about by drought, but initial results indicate a very satisfactory response by weaner steers to monosodium phosphate. The trial will be repeated at a later date in order to confirm preliminary results.

Lucerne has shown its ability to withstand extremely adverse conditions once successfully established and yields of up to one ton dry matter per acre have been reaped this year from dryland stands. Under irrigation yields of up to 14½ tons dry matter per acre have been obtained. The crop shows a direct linear response to superphosphate and a quadratic response to muriate of potash where both fertilizers have been applied in dressings ranging up to 1,400 lb. per acre. There appears to be no advantage in seeding lucerne at rates in excess of 12 lbs. seed per acre.

Lysimeter trials indicate that water barely percolated to a depth of four feet during the year—this where the cover was sparse. Under reasonably dense cover of grass percolation to this depth was not achieved. Run-off figures from the run off trial were also low and only in the completely bare treatment was the amount of water collected appreciable.

During the early stages of development of the Sabi Valley Experiment Station and up to and including 1057/58 summer season work was largely confined to agronomic investigations. Latterly fundamental work on water requirements and the effects of water and crops on soil conditions have received increasing attention, and much alteration and development has been required to provide the necessary facilities for this research.

Difficulty was experienced in obtaining good cotton stands during October and November due to the long period of hot, dry weather, but later planted crops grew well and some very high cotton yields were recorded. Maize also yielded well and a most encouraging wheat season was experienced. Of 24 varieties harvested, 17 yielded over 12 bags per acre.

Further laboratory tests were made on methods of measuring soil physical properties and the action of Sabi River water on passing through topsoil has been studied. Fertilizer studies have been continued.

At the Gatooma Research Station the overall picture was one of severe drought. A total of only some 18 inches of rainfall was recorded and distribution was very poor. Planting rains in November, 1959, were a failure and it was not until the second and third weeks of December that cotton and other crops were established. Mean yields were of the order only of 80 to 180 lb. clean lint per acre.

Only seed of Albar 637 has been issued to growers for planting in 1960/61. This variety now replaces the last of the U4 varieties in commercial cultivation. It is superior in yield, lint quality, bacterial blight resistance and ginning out-turn, and is also much more acceptable to the users.

Cotton insect pests control has continued, and the superior effectiveness of the insecticide Sevin is established.

In common with most other Stations the Agricultural Experiment Station at Salisbury had an unfavourable season for high yields of farm crops and a total rainfall almost 10 inches below normal.

Seed maize of S.R. Hybrid No. 12 was available to farmers in Southern and Northern Rhodesia for the first time. The most important characteristics of this hybrid are that it is slower maturing and more resistant to *Helminthosporium* leaf blight than any of the hybrids previously released.

The wheat breeding programme reached an important stage with the release of two varieties developed by the Wheat Breeder for bulking on farms. One of these, S29A1, has a great deal of rust resistance and should do well in general use, and the other variety released, Kafue, appears well adapted to conditions on the Kafue Polder. It is becoming increasingly apparent that the yields from summer wheat, even when weed competition is eliminated and the crop is free from rust, fall far short of those readily attainable in the winter, and it is thought that the future for wheat production in the Federation lies in the winter crop in spite of the cost of irrigation involved.

In the field of potato research the summer crop was free from attack by Late Blight for the first time for several years, and was also notable in that it saw the beginning of a breeding programme designed at the production of a blight resistant potato.

An investigation was started to measure the rotational value of ten of the more common farm crops grown on the heavier soils in the country. The indicator crop will be maize and the aim is to measure the rotational effect of the crop as distinct from the residual effect of the fertiliser and manure which it is normally given. This investigation will give the comparative yields of maize obtainable after potatoes, tobacco, sunflowers, wheat, kenaf, sunnhemp, soya beans, groundnuts, velvet beans and velvet beans ploughed under as green manure.

Among many developments during the year perhaps the most notable, certainly the most apparent, is the virtual completion of building operations at Chibero Agricultural College where a very fine institution has sprung up from virgin land.

Another import development, sought for years, was the provision for instruction in tobacco at Gwebi Agricultural College. The barns and grading sheds were under construction and seed beds had been established by the end of the year, and the first 10 acres of land to be planted to tobacco were in course of preparation. These facilities will round off the practical work at Gwebi and should lead to a very considerable improvement in field practice in particular.

An analysis of information compiled from questionnaires completed by old Gwebi students shows that 95 per cent. of those who gained a diploma at the College up to 1958 are engaged in practical farming or agricultural work in Government Departments or with agricultural firms. For the first time in the history of the College all 36 students of the First Year stayed out the full first year, and 32 of them qualified for the Second Year. Twenty-five out of twenty-nine finalists gained the Diploma, nine of them first class.

CHEMISTRY

There were no major staff changes during the year and steady progress could be maintained. The total number of samples analysed and reported upon amounted to 8,402 which, though slightly below last year's figure (9,169) represents a considerable output.

In the General Section, 4,012 samples were analysed, of which 3,175 samples were from other Government Departments and Research Stations, including 1,473 samples of feeds and faeces from feeding trials, 838 plant samples, 122 leachates, 364 blood samples and 657 toxicological specimens. Sixty-three samples of fertilizers, farm feeds and dips were analysed under the provisions of the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952. A new set of regulations for the Control of Agricultural Liming Materials was drafted. The Branch actively co-operated with the Standards Association of Rhodesia and Nyasaland in the preparation of standards for cattle, pig and poultry feeds and the drafting of standard chemical methods for such feeds. The collection of monthly radioactive fall-out samples for the U.S. Atomic Energy Commission was continued.

The Soil Testing Section issued reports on 3,631 advisory samples and 759 investigatory samples during the year, representing a total of 4,390 analysed samples. Though the number of routine soil samples received from farmers showed a drop of 20 per cent. as compared with last year, it was still 13 per cent. higher than that for 1957/58. Of the fertilizer recommendations issued, approximately 70 per cent. were for tobacco and maize at roughly equal proportions. Soil samples submitted by Northern Rhodesian farmers increased over the past few years and, if calculated per unit area of cultivated land, now equal the number of soil samples from Southern Rhodesia.

The Soil Survey Section carried out a number of field investigations, a considerable proportion of which were in the higher rainfall areas, and included surveys of several minor Native Department irrigation projects, experimental areas in the Stapleford and Erin Forest Reserves, the Melsetter Pasture Research Station, and tea-growing areas in Southern Rhodesia and Nyasaland. In addition, a considerable amount of laboratory work was completed.

In the Research Section investigations were continued on the biological activity, the organic matter status and nitrogen availability of soils. Good results were obtained with a new method of determining available soil phosphorus by means of anion exchange resins, and a certain amount of soil physical work was accomplished. A minor element survey based on plant samples collected in previous years was completed and valuable information regarding the copper, zinc and molybdenum status of Rhodesian crops and soils was obtained. Particular attention was paid to the problems of infertility of sandveld soils in laboratory as well as greenhouse studies. Improved spectrographic techniques were elaborated and a number of suspected minor element deficiencies in crops were investigated.

Fourteen scientific papers and popular articles were published by members of the staff during the year under review.

ENTOMOLOGY

There were a number of staff changes, particularly in professional staff, so that for the entire year the Branch was below full strength.

Following the discovery of pink bollworm in the Sabi Valley last year, steps were taken to reduce its incidence, or if possible, to eradicate it. This included the publication of regulations designed to ensure that there would be no cotton plants in the area of pink bollworm infestation during the months of August and September and a survey of possible alternative host plants when it was found that only *Hibiscus dongolensis* was of any significance. Accordingly, this plant was cut out by a team of African labourers over a wide area in the region of known pink bollworm infestation. The result of these measures has been that in 1960 pink bollworm infestation in cotton has been much lower than it was in 1959 and no spread has been recorded.

Ten species of fruit flies have been found in the Umtali area and the most common of them appears to be the Natal fruit fly. The Mediterranean fruit fly *(Ceratitis capitata)* has not yet been found in this area although it is known elsewhere in Rhodesia.

An entomologist worked with the Grain Marketing Board until June, 1960. He was concerned in particular with investigations into methods of applying insecticides to stacks of grain and grain stores and with measurements of the residual action and efficiency of insecticides in use.

Following further reports of trouble due to corn rootworm, an extended survey was made in the main maize growing areas of Northern Rhodesia on the line of rail from Choma to Broken Hill. The survey indicated that damage caused by the corn rootworm was widespread. As a result of the survey, insecticide trials and investigations into the biology and life cycle of this pest have been commenced in the 1960/61 season.

Well over 2,000 plant root systems were examined for the presence of plant parasitic nematodes and 75 soil samples were processed during the year.

A revision of the Plant Pests and Diseases (Importation) Regulations, which incorporated the recommendations of the fifth meeting of the Inter-African Phyto-sanitary Commission, and some minor amendments were published. There is still difficulty in ensuring that the provisions of these regulations are enforced in the northern territories due to the absence there of trained staff. Altogether 817 permits for importations were issued during the year.

BOTANY AND PLANT PATHOLOGY

No substantial change occurred in the personnel of the Branch during the year under review. Two officers, Mr. W. E. Kerr, Officer-in-Charge, Seed Services, and Mr. G. W. Herd, Plant Pathologist, proceeded to the United States of America and Canada on extended study tours under the auspices of F.A.O. and I.C.A. respectively.

The increasing importance of the Eastern Districts, especially in regard to the production of fruit and vegetables has long been recognised. To further assist in these developments a regional plant pathology laboratory was established at Umtali in July, 1960, with a senior Plant Pathologist in charge.

Welcome improvements to the facilities of the Branch included a large extension to the Herbarium, new offices and laboratory for the Seed Testing Section, and a plant growth chamber for wheat investigations.

Demands upon all sections of the Branch were greater than ever before. The Herbarium dealt with a record intake of 14,093 new accessions (10,000 in 1958/59) bringing the total collection to more than 111,000 specimens representing an increase of over 12 per cent. After many frustrating delays it is pleasing to report that the first part of Volume I of the *Flora Zambesiaca* was published in January, 1960. Good progress has been made with this long-term botanical project and Part 2 of Volume I is due for publication very shortly. Another landmark in botanical progress was the appearance, in April, 1960, of a new journal *Kirkia,* edited by the Senior Botanist. This is the first journal of its kind to be published in the Federation.

Weed problems were high-lighted by the explosive proliferation of the aquatic fern, *Salvinia auriculata,* on Lake Kariba. Much attention was given to this and other weed problems affecting dams and farming generally. More detailed studies of poisonous and medicinal plants were instigated.

The insistent demands of our developing seed production industry again tended to curtail the research programme on seed-borne diseases and other aspects of seed production. Important long-term investigations on maize and tobacco were, however, continued whilst more comprehensive studies on vegetable seed production were commenced.

The numbers of samples and inquiries handled by the Seed Testing Laboratory increased substantially and, despite the provision of improved facilities and equipment, it was difficult to prevent occasional delays in supplying reports and advice. With the exception of grass seed where growers experienced a difficult season and production of certified seed fell by nearly 50 per cent. to 56,000 lb., all other branches of the industry continued to expand. The final figures for certified vegetable seed are expected to reach nearly 2,000,000 lb. compared with 750,000 lb. the previous year. Most of this consists of peas and beans. The Tobacco Seed Association increased its production from 1,652 lb. in 1958/59 to 5,200 lb. of certified seed in 1959/60. Sales reveal that more than 85 per cent. of the tobacco growers throughout Northern and Southern Rhodesia used certified seed for their 1960/61 crop. It has now been possible to establish a tobacco seed bank to ensure continuity of supply of certified seed. Production of certified seed potatoes also increased, but due to the overlapping of one season with another no exact figures are yet available except in the case of the highest quality "A" grade of which some 6,200 pockets (75 lb.) were sold.

Fresh ground was broken by the introduction of an approval scheme for seed wheat.

CONSERVATION AND EXTENSION

Despite the very difficult season that was experienced, particularly in Southern Rhodesia, tobacco farmers produced a record crop; maize producers were adversely affected by the erratic and poorly distributed rains and many lost very heavily. Cattle ranchers in most parts of Matabeleland had one of the worst seasons on record and thousands of head of stock had to be moved away from the drought-stricken areas.

The year has been one of achievement by the Department, not only in the mechanical conservation sphere, but also in the extension field. Through the medium of personal visits, farmers' days, discussion groups, newsletters and articles in the Press, the gospel of wise land use and the principles of good husbandry have been enunciated and emphasized.

Once again very satisfactory progress was made in soil and water conservation, the number of dams built during the year eclipsing all previous records.

Land Use Planning continued to receive the highest possible priority, the tempo of work in this direction being maintained by the field staff who are now all thoroughly trained in the necessary techniques. Their efficiency in this and other aspects of their work has been maintained at a high level by regular in-service training.

Erosion control research work at Henderson Research Station continued as did the first phase of the drainage research programme. Satisfactory progress was also made in the hydrological study of run-off from small catchments and in the study of various methods of stabilizing highly erodible mopani soils.

Field experimentation received considerable attention during the year—no less than 140 trials and demonstrations being carried out in Northern and Southern Rhodesia. Good work was done on the Government Experimental Farms run by the Department in helping to solve local agricultural problems and in demonstrating sound methods and systems of farming in their respective areas.

Many conservation field visits for teachers were organized during the period covered by the report and the importance of the need for conserving the country's water resources was stressed most successfully during Conservation Week in July. Conservation Education continued to be taught as a subject at the Heany Teachers' Training College near Bulawayo.

Good progress was made by the Young Farmers' Club movement in both territories, a notable development being the change in sponsorship in Southern Rhodesia from the Department of Conservation and Extension to the Natural Resources Board.

I.C.A. Committees functioned with great efficiency during the year, working in close and cordial co-operation with the staff of the Department of Conservation and Extension.

VETERINARY SERVICES

The Department has been under strength throughout the year. There is a world shortage of veterinary surgeons, and conditions elsewhere seem to attract candidates more than those here. In order to encourage local young men to join the Department an increased bursary scheme is to be implemented.

An outbreak of foot and mouth disease was confirmed on 27th June in a small herd of cattle maintained at the Headquarters of the Wankie Game Park; another outbreak occurred on 5th July on Maitengwe Crown lands (100 miles to the south), and a third on 8th September at Kazengula (130 miles to the north-west). These centres had a large cattle population between each. The Maitengwe outbreak was adjacent to similar infection in the Bechuanaland Protectorate. This outbreak, in contrast to the other two, has not been easily isolated and has spread into the Nata Native Reserve: the area was suffering from drought, and the resulting lack of water and grazing militated against effective cattle breaks being established.

The Bechuanaland Protectorate authorities appealed for assistance to control a large outbreak of foot and mouth disease in that portion of the Protectorate; the services of one Veterinary Officer and twelve Animal Health Inspectors were made available.

The game fence adjacent to the Wankie Game Reserve is under construction; a fence is also being erected along the Bechuanaland Protectorate border to link up with the existing fence running north from Plumtree. When these are completed there will be a fence from Plumtree to the Gwaai River.

There has been a continued reduction in the incidence of rabies. 15 cases were confirmed during the year compared to 28 in the previous year. All cases except one occurred in districts bordering other countries.

The overall trypanosomiasis position is largely unchanged, except for the south-eastern area, which has caused some worry; however a combined bush clearing and insecticidal attack has already begun to show results. Cattle continue to be successfully maintained in lightly infested areas through the medium of trypanocidal drugs. The small field experiment station at Kariangwe in the Binga district has closed down because of the development of resistant strains of trypanosomiasis to prophylactic drugs, and also because of shortage of staff. It is proposed to integrate the Departments of Veterinary Services and Tsetse and Trypanosomiasis Control in the interests of added efficiency.

Small progress only has been made in the Tuberculosis Eradication Scheme. An additional 314 head were tested during the year, the number of dairy cattle under test now being 38,295 (about 60 per cent. of the total).

Of the infertility diseases contagious abortion now presents no problem as it can be readily, economically and efficiently controlled by vaccination. Contagious epididymitis and vaginitis (epi-vag) continues to decline in incidence; only 21 properties are under quarantine restrictions compared to 32 at the end of the previous year. Vibriosis still causes some concern, but the use of antibiotics and artificial insemination can quickly bring the infection under control.

There has been a distinct improvement in tick control, which perhaps was helped by drought conditions. More logical thought is being shown with regard to the use of organic acaricides.

Research on poisonous plants, on which little work has been done heretofore, has been taken up and pursued with vigour.

The Artificial Insemination Service continues; the number of doses used increased from a total of 6,086 the previous year to 8,036. This increase is gratifying but still not enough. An Artificial Insemination Advisory Committee has been set up.

TSETSE AND TRYPANOSOMIASIS CONTROL AND RECLAMATION

The main feature of the year has been the progress made in substituting other techniques in place of game destruction as the main method of control of tsetse fly. In the South eastern lowveld shooting stopped in January and in the Sebungwe area encouraging results in the use of insecticides led to the decision to cease shooting at the end of the report year.

The situation in the Sabi valley continues to be a source of anxiety—although the increasing acreage of bush clearing, extension of patrol systems and completion of the vegetation survey of the area are reducing the hazards—due to unpredictable movements of *Glossina*.

In Binga District the use of dieldrin sprayed from knapsack sprayers on selected vegetation occupying about five per cent. of an experimental area of a hundred square miles led to a 98 per cent. reduction of the fly population eight weeks after completion of spraying.

Progress has been made in extending the amount of time devoted to investigation and the Field Research Station at Rekomitjie is now completed. Elsewhere the erection of semi-permanent houses has greatly improved the amenities available for staff permanently residing in the bush.

13th March, 1961.

DEPARTMENT OF RESEARCH AND SPECIALIST SERVICES ANNUAL REPORT FOR THE YEAR ENDING 30th SEPTEMBER, 1960

Dr. B. S. ELLIS,
Director of Research and Specialist Services

STAFF

During the year the staff position was fairly satisfactory, although many Branches and Stations report a progressive and general decline in the standard of applicants—with, of course, the usual exceptions. The considerable increases in recent years in salaries for comparable professional posts in the countries from which we used largely to draw our recruits, as well as in the Colonial Service and other agricultural and research organizations, have clearly had an effect, and the uncertainty of the political situation here, magnified and distorted as it is in Britain, has not helped. This is a situation which can only be viewed with great concern, and which sooner or later must be remedied. Prospects in research in the Federation, and particularly in this Department, must be sufficiently good and, therefore, stable and compettive, to attract the best scientists, and not such as merely to afford a haven for the poor or the indifferent. The quality of research in this country has been in the past very high, and much of the general agricultural progress owes more than is realized to it. But good research depends on good men and is impossible without them.

The Director was on leave during the year in the United Kingdom. During his stay overseas he attended several conferences and represented the Federal Government at the tercentenary of the Royal Society in London. For this whole period Mr. T. K. Sansom acted as Director and Dr. G. R. Bates as Assistant Director.

For the third year running the very important post of Chief Horticulturist remained unfilled, in spite of strenuous, widespread efforts. At the end of the year the prospects of filling the post were brighter than for some time.

The general staff situation is indicated in the following table:

Establishment:	
Superscale Posts	17
Senior Professional Officers	35
Professional Officers	57
Technical Officers	102
Clerical Posts	31
*Other Posts	4
African Posts	75
Contract Posts	1
TOTAL	322

* *Other Posts* consist of 1 Handyman (Henderson), 2 Matrons (Gwebi), 1 Groundsman/Handyman (Gwebi).

Resignations, etc.:	
Technical Assistants	10
Professional Officers	6
TOTAL	16

(Includes one death and one retirement.)

Transfers:	*From Dept.*	*To Dept.*
Professional Officers	–	2
Technical Assistants	2	–
TOTAL	2	2

Officers Appointed:	
Professional Officers	6
Technical Assistants	17
TOTAL	23

Vacant Posts:	
Superscale	1
Professional Officers	4
Technical Assistants	4
TOTAL	9

RESEARCH

The Agricultural Research Council, which had been constituted at the end of the previous year, held its first meeting early in the year under review. There was a considerable amount of preparatory work to be done in the collection and co-ordination of information, and the Director of Research and Specialist Services was appointed Chairman of an *ad hoc* committee of the Council, known as the Fact-Finding Committee, charged with completing this laborious, tedious but essential task. The fact-finding committee also scrutinized proposals for survey and other interim projects which could be considered as an essential or desirable preliminary to the main work of the Council, and which might usefully be done while the Council was, so to speak, girding up its loins. At the last meeting of the year the Council met on probably its most important business, and appointed Dr. H. C. Pereira, of the East Africa Agriculture and Forestry Research Organization, as its Director.

In the sphere of departmental research the second annual policy meeting was held and proved most informative. The subject which received most attention, as at the inaugural meeting, was crop ecology. The subject of farming systems too was very extensively discussed; other matters which were dealt with included priorities in entomological research, meetings at specialist branches in addition to research stations, general research priorities, dairy research, low-rainfall crops, and various administrative and organizational questions.

At the annual meetings of the Departmental Research Advisory Committee at the research stations the chair was taken in most instances by Mr. Raath. Various problems and matters of concern which had not before become so evident were emphasized, and a further policy meeting was arranged early in the following year.

Owing to the setting up of the Research Council and the frequent meetings of the fact-finding committee referred to above, which included research representatives of the three territories, much of what was previously discussed by the Federal Research Advisory Committee was dealt with, and in fact only one meeting of the Advisory Committee was held during the year. The feeling of the Committee seemed to be that until it is clear what the detailed policy of the Council is to be, there is no point in convening meetings unless some matters of real urgency or common concern develop. To a certain extent the science conferences of the Department, to which territorial representatives are invited, fill part of the role which the Committee was designed to play.

In general it can be said that the research and investigatory work of the Department continues very satisfactorily. Owing to economic pressures and necessities it is probable that there has been some constriction in the field covered, but that has meant that attention is being given to more fundamental and critical studies. Such research is, of necessity, long term and requires sustained effort and enthusiasm. In the field of horticulture, due largely to our failure to recruit a Chief Horticulturist, research lags behind that of other Branches. But in spite of the absence of a Chief Horticulturist firm plans for sound basic research have been made, in conjunction with the Fruit Growers' Association, and the necessary preparatory work is well under way.

FEDERAL STANDING COMMITTEE ON AGRICULTURAL PRODUCTION

Several meetings of this valuable committee have been held during the year and the committee in August visited the lowveld areas of Southern Rhodesia. spending some time at the Sabi Valley Experiment Station.

STUDY TOURS OVERSEAS

I make no apology for referring again to the very great generosity of the International Co-operation Administration of the United States, and the United Nations Food and Agricultural Organization which through grants, have continued to enable many of our research officers to participate in the most recent research in the world in their field. The wide dissemination of expert knowledge, related to world and local conditions, which results from such studies, is having a very great effect on the general level of research here. It would not be too much to say, I think, that the opportunities which have been afforded us have enabled us, along I am sure with other Departments, to develop a cadre of travelled, assured, up-to-date specialists which, proportionately, must be as significant as any in the world.

GENERAL

Although it does not receive its first students until October, 1961, the growth of the Chibero Agricultural College during the year deserves special mention. With the appointment of Mr. Walsh as Principal, recruitment of staff began and the growth of the very fine college buildings, now about complete, is matched by preparations for the field work which is, of course, an integral part of the college activities. A widely representative Council, with Lord Acton as chairman, is very vigorously assisting in the birth of what will unquestionably be a landmark in the history of federal agriculture.

The Cotton Pest Research Scheme, a research effort financed jointly by the Federal and Nyasaland Governments and by the Colonial Development and Welfare Fund, continued its very promising work. This probably unique undertaking which is concentrating its main research effort at the Gatooma Station, is reinforcing this field research by subsidizing fundamental research at the University College of Rhodesia and Nyasaland.

Attendance at committee meetings, frequently as chairman, occupies much of the time of the Director. The Fertilizer Advisory Committee, which attempts to bring out the smallest, and therefore the cheapest, range of fertilizer mixtures to cover all the soil and crop needs of the country, runs into a good deal of contention and into apparently irreconcilable points of view. However, it has recently attempted to clarify and crystallize its aims, and to regularize its procedure, and all members agree that it performs an essential function, though not always to everyone's satisfaction.

The year was marked by a severe drought which, although serious in its consequences, was not without its valuable lessons. As will be seen from the sectional reports the drought underlined certain fundamental principles of Agronomy and Veld Management which had tended to be forgotten in the years of good rainfall, and it emphasized again that probably our most urgent line of research is in crop ecology.

COMMITTEES AND BOARDS

The Director, or his deputy, served on the following committees and boards:

Federal Standing Committee on Agricultural Production (Chairman).
Federal Research Advisory Committee (Chairman).
Departmental Research Advisory Committee (Chairman).
Fertilizer Advisory Committee (Chairman).
Agricultural Research Council.
Tobacco Research Board.
Seeds Research Advisory Committee (Chairman).
Sabi Valley Development Co-ordinating Committee.
Tsetse and Trypanosomiasis Committee.
Scientific Advisory Committee.
Committee on Irrigation and Drainage.

Senior Officers of the Department served on numerous inter-departmental and other committees.

VISITS OUTSIDE THE FEDERATION

The following officers attended various meetings and conferences or participated in study tours:

Dr. B. S. Ellis, whilst on leave, attended an International Conference on Irrigation and Drainage held in Madrid; also attended a Congress of the Commonwealth Agricultural Bureaux in the United Kingdom, which included visits to many of the most important research stations in Britain. Dr. Ellis also represented the Federal Government at the Tercentenary of the Royal Society in London.

Dr. O. West attended an International Grasslands Conference in the United Kingdom.

Mr. J. C. Raath went to Pretoria as the Government representative on the Pig Testing Centres Committee of South Africa.

Dr. D. H. Saunder attended the Third Inter-African Soils Conference at Dalaba in Guinea.

Dr. P. M. Grant visited Rothamstead for one day whilst on leave in the United Kingdom.

Mr. D. G. Bushnell visited the U.S.A. on a study tour under the auspices of the I.C.A. and whilst there attended the Seventh International Soil Science Conference in Madison.

Mr. R. G. Jones visited the Union of South Africa to judge at the Rand Easter Show.

Mr. T. S. Leadley visited the United Kingdom to study methods of usage, collection and analysis of milk records.

Mr. J. A. Whellan attended the Fourth Meeting of the Inter-African Phyto-Sanitary Commission in London.

Mr. A. J. M. Carnegie visited Espungabera, P.E.A., on a survey of pink bollworm.

Mr. G. Townsend paid three visits to Beira on tobacco inspection duties.

Mr. W. E. Kerr visited the U.S.A., Canada, the United Kingdom, Europe, and the Middle East under the auspices of the F.A.O. to study seed production, testing and legislation.

Mr. G. Herd visited the U.S.A. and Canada under the auspices of the I.C.A. to study wheat rust problems.

Dr. H. Wild attended a meeting of the Editorial Board of *Flora Zambesiaca* in Lisbon.

Dr. G. R. Bates attended the annual meeting of C.C.T.A. in Madagascar; also attended the annual meeting of C.S.A. in Cape Town and a C.S.A. specialist meeting on water treatment in Pretoria, whilst on leave.

Dr. W. L. Fielding went to South Africa on an investigation of Agricultural High Schools there.

Mr. H. R. L. Mundy visited South Africa to judge at the Rand Easter Show and also to select stud stock for Gwebi Agricultural College.

Mr. A. G. H. Rattray attended the South African Maize Breeders' Conference in Pietermaritzburg.

Mr. F. Puczylowski visited various agricultural institutions in the United Kingdom whilst on leave there, to obtain information on vegetable seed production and horticultural research in general.

Mr. F. E. M. Gillham visited the U.S.A. on a Fullbright Scholarship to study genetics and biometrics at the North Carolina State University.

Mr. P. A. Donovan attended the South African Maize Breeders' Conference in Pietermaritzburg.

Mr. J. M. Rattray took up a four months' appointment with the F.A.O. as an Agronomist on a Technical Assistance Mission of the United Nations to the Government of Northern Nigeria.

SECTIONAL REPORTS

There follow the annual reports of the Branches, Stations, and Agricultural Colleges which constitute this Department, together with a report on Crop Production. Although the general purpose of the annual reports is the same there is no specified form of presentation, and by design and intent the shape and style of what he has to relate are left, in each case, to the individualist responsible for his own section of the report.

ACKNOWLEDGEMENTS

I would like to express my appreciation of the efforts of all members of the staff for their loyalty, enthusiasm and hard work, often in the face of disappointment.

I would like as before to mention the close and friendly co-operation between this Department and the Department of Conservation and Extension in particular and the efforts continuously made to ensure the most harmonious working of research and extension services. Co-operation with other departments and indeed with other Ministries and even Governments, is equally close and friendly, even though, of necessity, it is more discontinuous. The Department continues to face the future with confidence.

CROP PRODUCTION

T. K. SANSOM, *Assistant Director of Research and Specialist Services*

SEASONAL CONDITIONS

On the whole, the season has been a poor one. In some places, notably in the centre and south of the country, the drought has been severe. As in the previous two seasons the rains were late in coming, and October and November totals were on the whole low. When the rains did arrive in December, however, widespread and heavy falls seemed likely to make up the deficit of the previous months.

January brought a marked change in conditions. The low pressure trough which normally develops east of Mongu failed to do so, and the upper air was much drier than the normal for January. As a result, instead of the frequent and often heavy falls usually to be expected, only scattered showers were recorded. A few stations had no rain at all throughout the month and in the south and west of the country there were large areas where only extremely small totals were recorded. Even on the few days when rain was fairly widespread, amounts were very small. February brought more relief to the north and east of the country but for the worst hit areas of the west and south there was little alleviation of the drought conditions. The showers which fell in March were too light to be of much assistance and it was not until the end of April that almost the whole country received unexpected heavy rains which lasted for two or three consecutive days. Coming so late in the season when losses by evaporation were substantially lessened, these falls did much to improve winter grazing but delayed the harvesting of the maize crop and caused considerable damage to hay crops, and they were not enough to make any really substantial improvement in the water supplies for the dry season.

THE MAIZE CROP

Estimate of Yields

The final forecast of the European-grown maize crop in Southern Rhodesia is approximately 2.7 million bags from 350,000 acres. This represents an average yield of only 7.7 bags an acre which is considerably lower than the yields of the previous three seasons and is about the same as for 1954/55 season.

The acreage planted is slightly more than in the 1958/59 season and is approximately the same as that of the 1957/58 season, but the total yield and yields per acre are considerably less as the following table shows.

Season	Number of Growers	Area Planted	Crop Reaped	Yield per acre
1950/51	3,916	343,521	1,176,528	3·42
1951/52	4,095	361,024	2,454,047	6·80
1952/53	4,176	363,204	2,360,011	6·50
1953/54	4,154	359,709	2,678,314	7·50
1954/55	4,170	364,059	2,734,920	7·51
1955/56	4,087	342,509	3,434,797	9·74
1956/57	4,162	371,062	3,777,021	10·2
1957/58	3,997	349,270	3,589,600	10·3
1958/59	4,000	340,000	3,500,000	10·3
1959/60 (estimated)	4,029	350,000	2,700,000	7·7

The season again was most unfavourable as the main rains again ended early in March with the result that the grain did not fill out as well as it should have. A feature of the season was the localized character of the rainfall. It was quite a common occurrence for one farm to receive excellent rains which were well distributed whereas neighbouring farms received very little rain with extremely poor distribution.

Although the total crop is considerably lower than during the past four seasons it will not be necessary to import maize owing to the substantial reserve which was carried over from the previous crop.

RHODESIA SEED MAIZE ASSOCIATION

Final Report for the 1958/59 Season

During this season members produced their eleventh crop of hybrid seed maize. More seed were marketed by fifty-seven members than in any previous year. The agent in Salisbury handled approximately 67,500 pockets; Bulawayo and Gwelo agents, 1,000 pockets; making a total of 68,500 pockets. This is 3,000 pockets more than in the previous season and nearly 20,000 pockets more than were sold in the 1956 season.

Drought conditions prevailed during the normal sowing season and created an abnormal demand for seed from farmers who had failed to provide adequate supplies during the period when an abundance of seed was available. Hybrid No. 12 was available to commercial growers for the first time during this season. Difficulty was experienced in the production of this seed through the necessity for sowing at different dates in order that the flowering periods of the two parents might coincide. It has been decided to combine the inbred strains in a different manner and thus endeavour to obtain better synchronization in the growth rate of the parent strains.

Interim Report for the 1959/60 Season

The total area sown for hybrid seed production is 4,400 acres. Of this acreage 4,200 acres have produced seed for sale. This is 450 acres more than last year but owing to the late arrival of sufficient rain to permit the crops to be sown and the drought conditions which followed crops are considerably lighter than last year. Nevertheless it is anticipated that most members will fulfil their allotted quotas and more will produce considerably more than their quotas.

Seed Maize Prices

There has been no change in the prices of certified double hybrid seed of large and medium flats, small round and certified and uncertified open pollinated seed, but the price of certified double hybrid large round seed has been increased from £3 10s to £5 10s. a bag of 200 lb. In addition a new grade, certified double hybrid small flats seed has been introduced owing to the poor season. This grade is being sold at £5 a bag of 200 lb.

Hybrid Maize Farm

The fourth crop of single hybrid seed has now been produced on Panmure Hybrid Maize Farm. The amount of seed produced was not sufficient to supply the needs of the Rhodesia Seed Maize Association. This was due to the extremely severe drought experienced. However, as stated in last year's report, arrangements were made with growers near to Salisbury to produce seed to supplement that produced at Panmure. The result of this arrangement has been that all of this season's requirements have been met and it has been possible to store in reserve supplies almost sufficient for the following season's requirements.

The seed produced at Panmure, has, in spite of the drought, been of very high quality and many complimentary reports on it have been received from growers.

Small acreages of wheat of several different varieties have been planted as in the past for the Wheat Breeder in order to bulk up supplies of pure live varieties for distribution to farmers.

Fire-cured and Burley tobacco experiments, limited to a maximum of five acres a year have again been planted, but at the beginning of this year it was agreed at a meeting which was attended by members of the Fire-cured Tobacco Committee and of this Department that tobacco experiments would no longer be conducted at Panmure as it was considered that they could be done very much better in Northern Rhodesia.

The small plots of four varieties of sugar-cane continue to grow well and up to the present have not been affected by frost.

WHEAT

Summer Wheat

There has been no increase in the acreage planted to summer wheat during the past year. Although varieties have been bred which yield satisfactorily under summer conditions, if kept free of weeds. The weed problem still remains the greatest obstacle in the successful production of this crop on farms. A new approach to this problem consisting of sowing a green manure crop, such as sunnhemp, late in November or very early December, drilling the wheat in this crop early in January and killing the green manure crop immediately after drilling with chemical weed killers will be tried out experimentally during the coming summer. The results of this experiment are awaited with interest.

Trial plots embracing fertilizer, spacing, rate of seeding and spraying trials embracing weed control continue to be done on the various Government Research Stations.

Winter Wheat

Winter wheat production continues to decline, only 6,700 bags were produced from 1,590 acres. The total crop amounted to 3,800 bags less than in the 1958 season and 8,641 bags less than in the 1956 season. Over twenty years ago winter wheat production amounted to nearly ten times as much as the crop reaped in 1959. The story of wheat growing continues to be a sorry one of ever-decreasing production while at the same time the Federation's consumption continues to increase rapidly. There is no doubt whatever that this country could easily grow well over 100,000 bags a year on present irrigation schemes on the high veld and also on moisture-retaining soils, as the Wheat Breeder has produced varieties which are very highly resistant to the incidence of rust attack, yield well and are very well adapted to the winter conditions on the high veld.

GENERAL CROPS

Sorghum Production

There has been considerably more interest shown in sorghum growing during this season than for a number of years past. This is in part due to the dry seasons experienced and also to the fact that a fairly good demand for sorghums of the K 2 red type for malting purposes exists. During the year a meeting was held between representatives of this Department, the Department of Conservation and Extension, the Grain Marketing Board, the Department of Native Agriculture and the brewers to discuss all aspects of sorghum production, marketing and usage and a sub-committee was formed to encourage the production of good malting varieties of sorghum in the lower rainfall areas of the country. The malting varieties are from the Union of South Africa, but it is considered that a number of varieties bred at Matopos Research Station are equally good for malting purposes. These will be bulked up in order that a sufficient amount can be made available for malting tests.

Potato Production

The demand for seed produced by the Southern Rhodesia Seed Potato Association far exceeds the supply. This is proof of the high regard in which this seed is held. During the past season arrangements have been made, with the National Parks Board, for the maintenance of elite stocks and registered varieties of potatoes on a piece of land above the Mare Dam at Inyanga. It should be eminently suitable for the maintenance of seed stocks as it is at an altitude of well over 6,000 feet, has an easterly aspect and so catches all the prevailing wind and has an adequate rainfall. This should ensure that no degeneration takes place because of virus infection which is carried by aphids but which should not be present at this altitude and aspect.

Kenaf (Hibiscus cannabinus)

No kenaf was grown by farmers for commercial production during the past season. This was due to there being no market for the crop owing to the closing down of the Umtali Jute Mills during the year. Attempts have been made to find an export market for the fibre. A great deal of interest was shown by officials of the spinning-mills at Benoni in the samples of fibre produced and the writer was assured that there would be no difficulty whatever in selling a large tonnage of fibre of the quality produced at an economic price to growers. Unfortunately funds were not available to provide retting and other facilities which were necessary to produce fibre of the quality demanded by the mills.

Castor Bean

There is a small but steady demand for castor bean seed for the extraction of oil for medicinal purposes in the Colony.

This is one of the few crops in which world demand far exceeds supply and there are large areas in Southern Rhodesia which are very well suited for castor bean production, but for some reason or other farmers have not taken to it to any considerable extent.

Groundnut Research and Productivity

The Field Officer, Groundnut Research, has, since the beginning of July, 1960, worked full time on groundnuts. In addition to his research activities he has also given assistance to the Department of Conservation and Extension in a campaign arrived at popularizing this crop and extending its production to European farming areas.

A visit by Mr. Sellschop of the College of Agriculture and Research Institute, Potchefstroom, was arranged during April and May, 1960. The Field Officer helped to plan an itinerary and accompanied Mr. Sellschop over those parts of his tour which embraced Southern and Northern Rhodesia. A report on the groundnut situation by this eminent authority is expected shortly and the contact made has already brought rich dividends, in the way of helpful comment and advice as well as a mutually advantageous exchange of ideas and seed stock.

The preliminary work done at the Henderson Research Station in 1958/59 provided material which was used in three main experiments at this station carried out in the 1959/60 season. These were:

(1) An "Earlies" variety trial with 25 varieties or strains.

(2) A "Late" variety trial with 25 varieties or strains.

(3) A combined variety and "Ridge" versus "Flat" cultivation trial using two early and two late varieties.

In addition, by courtesy of the Director of Conservation and Extension, ridge versus flat trials with one early variety were done at Chipinga and Karoi Demonstration farms. The Karoi farm also planted observation plots of one early and two late varieties which indicated that both might be successfully grown in this area of good rainfall and relatively high temperatures.

In all trials there was no significant difference between ridge and flat planting and either practice may be safely recommended for the better rainfall areas under seasonal conditions as experienced in 1959/60. The rains were late, sparse and poorly distributed and provided a severe test of both cultivation practice and variety. In a wetter year it is probably that sowing on the ridge will show to greater advantage in yield, and even in the past season all three stations reported that lifting was easier and more efficiently performed from ridged plots.

In general the early varieties showed to advantage both in yield and in quality. They were also far superior in shelling percentage to the lates. The mean shelling percentage, weight of kernels as a percentage of pod weight, for the 25 earlies under trial was 68.1 but for the same number of lates only 43.4. This result may be in part seasonal, but the greater demand for calcium in their podding zone by the lates may be also to blame. This matter is to be investigated in the 1960/61 season by extending gypsum trials, already begun at Grasslands Research Station, to a wide range of exports elsewhere.

A total of 108 strains and varieties supplied by the Plant Breeder, Mount Makulu Research Station, Northern Rhodesia, and five new locally made selections, were planted in progeny rows at Henderson Research Station. These have provided a wealth of material for future study and enough seed for distribution on a wide basis to other stations.

Of particular interest for Southern Rhodesia are sub-strains of Valencia which may be superior to existing commercials stocks particularly in the firm attachment of their nuts to the haulm with consequently lessened risk of pod loss at harvest. There are also types of Natal Common now available which may be superior to standard South African stocks at present in use. Seed of these has already been supplied to Potchefstroom at Mr. Sellschop's request. Several of these are from selections made in Southern Rhodesia in 1958. There are now a number of lines derived from late varieties which show promise for the better rainfall areas of Southern Rhodesia and there is much interest in some lines from Bambey in Senegal which are reputedly resistant to Rosette Virus.

Although emphasis is mainly on rain-grown nuts there are parts of Southern Rhodesia where irrigation offers good prospects of high yields. Seed of two late maturing varieties was sown in observation plots at the Sabi Valley Experiment Station, and results suggest that such dormant seeded types may be well suited to irrigated lands. It was found, however, that *Cercospora* leaf spot may be a critical factor at the lower elevations since a heavy attack developed on the Early Runner variety. It had an indirect advantage in providing opportunity for some single plant selection and what may be a resistant form has been isolated from the variety named above. In addition trials with Valencia Bunch in close spacing showed that very high yields may be obtained with early non-dormant seeded types as well, although harvest proved rather difficult in the intractable soil conditions of the Sabi Station. Better results were obtained on trials by the Department of Native Agriculture at their Nyanadzi Station with both early and late varieties.

A further range of *A. hypogea* material for trial in 1960/61 is being supplied by Mr. Sellschop and also six stocks of perennial groundnut species for work in co-operation with the Chief Pasture Research Officer. With these there is available almost the entire range of genetic material provided by *Arachis* spp.

AGRICULTURAL SHOWS

The Assistant Director of Research and Specialist Services judged the maize and agricultural produce and district exhibit sections at the Salisbury, Bulawayo, Umtali and Gwelo Shows. Considering the bad season the exhibits were well up to the standard of previous years.

ACKNOWLEDGEMENT

I am indebted to the Director of Meteorological Services for the information supplied on seasonal conditions.

ANIMAL PRODUCTION

J. C. RAATH, *Chief Animal Husbandry Officer*

The year under review has been an extremely poor season for cattle production. During the 1959/60 summer period the last rains in many areas fell at the end of January, 1959, and no precipitation occurred again until the end of December, 1960. Rainfall was well below normal and badly distributed, resulting in serious drought conditions in many parts of the country. In consequence of these conditions emergency drought relief measures were brought into operation by the Government to assist in reducing the detrimental effects on production.

THE BEEF INDUSTRY

Below are given figures for the cattle population in the Federation as well as some details of the European-owned cattle population in Southern Rhodesia over the past five years.

NUMBERS OF EUROPEAN- AND AFRICAN-OWNED CATTLE IN THE FEDERATION (in thousands)

Year	Federal State		S. Rhodesia		N. Rhodesia		Nyasaland	
	European-owned	African-owned	Eurpn.-owned	African-owned	Eurpn.-owned	Africon-owned	Eurpn.-owned	African-owned
1955 . . .	1,382	3,069	1,246	1,901	126	871	10	297
1956 . . .	1,492	3,136	1,344	1,937	138	891	10	308
1957 . . .	1,600	3,190	1,434	1,981	155	892	11	317
1958 . . .	1,687	3,320	1,506	2,074	167	917	14	329
1959 . . .	1,747	3,384	1,553	2,087	179	955	15	342

DETAILS OF EUROPEAN-OWNED CATTLE IN SOUTHERN RHODESIA

Year	Total Number	Number of Cows	Number of Calves	Total losses
1955 . . .	1,246,254	449,306	206,746	65,043
1956 . . .	1,344,136	485,926	255,071	54,846
1957 . . .	1,434,115	524,291	270,093	57,443
1958 . . .	1,506,199	563,426	269,384	62,567
1959 . . .	1,552,880	555,620	267,134	60,614

The increase in the cattle population during 1959 was not as substantial as it had been during the previous four years. This indicates that the difficult conditions mentioned in the previous report had a retarding effect on the expansion of the cattle industry. According to the details of European-owned cattle in Southern Rhodesia the number of cows and calves remained at the same level while losses also showed no increase.

Supplies of Slaughter Stock

The following table indicates the total supply of slaughter cattle from European and African sources in the Federation, but excludes cattle slaughtered for consumption in African reserves:

Year	Federal State	Southern Rhodesia	Northern Rhodesia	Nyasaland
1955 . . .	323,683	260,430	40,113	23,140
1956 . . .	303,012	237,069	39,283	26,660
1957 . . .	330,717	264,355	37,613	28,749
1958 . . .	351,545	282,030	40,366	29,149
1959 . . .	402,251	345,894	41,767	14,590

Numbers and grades of cattle slaughtered in the controlled areas of Southern Rhodesia for the year ending 30th September, 1959:

A. — COMBINED TOTALS C.S.C. PLANTS, SOUTHERN RHODESIA

Grade	Oxen	Cows and Heifers	Bulls	Total 1960	%	Total 1959	%
Rhodesia Best	3,574	241	—	3,815	1·59	3,119	1·36
Imperial	9,503	525	—	10,028	4·18	11,020	4·79
Standard A	37,427	3,179	—	40,606	16·93	52,450	22·82
G.A.Q.	42,043	26,131	—	68,174	28·41	75,331	32·77
F.A.Q.	30,298	21,258	—	51,556	21·49	40,696	17·70
Compound	25,500	21,235	2,882	49,617	20·68	36,481	15·87
Inferior	3,079	12,601	435	16,115	6·72	10,772	4·67
TOTAL	151,424	85,170	3,317	239,911	—	229,869	—

B. — COMBINED TOTALS FOR PRIVATE BUTCHERS IN SOUTHERN RHODESIA

Grade	Oxen	Cows and Heifers	Bulls	Total 1960	%	Total 1959	%
Rhodesia Best	431	117	—	548	1·57	561	1·48
Imperial	1,432	364	—	1,796	5·16	2,093	5·52
Standard A	2,999	1,296	—	4,295	12·72	5,792	15·29
G.A.Q.	4,042	5,957	—	9,999	28·72	11,680	30·84
F.A.Q.	2,392	4,191	—	6,583	18·91	6,956	18·37
Compound	2,919	4,930	1,369	9,218	26·47	9,050	23·89
Inferior	250	2,086	46	2,382	6·84	1,746	4·61
TOTAL	14,465	18,941	1,415	34,821	—	37,878	—

COMBINED TOTALS AND GRADES OF CATTLE SLAUGHTERED IN NORTHERN RHODESIA FROM 1.1.60 TO 30.9.60

Grade	C.S.C.		Private Butchers	
	Number	%	Number	%
Rhodesia Best	125	1·58	113	1·16
Imperial	300	3·80	349	3·59
Standard A	1,561	19·74	2,019	20·80
G.A.Q.	2,217	28·03	2,515	25·91
F.A.Q.	1,455	18·40	1,546	15·93
Compound	1,326	16·77	2,051	21·13
Inferior	924	11·68	1,115	11·48
TOTAL	7,908	—	9,708	—

National statistics indicate that the total supplies of slaughter stock in the Federation during 1959 exceeded the previous year by 50,000 head. Available figures for the year ending 30th September, 1960, reveal that a similar large increase in supplies was not maintained. Supplies of slaughter stock in the controlled areas of Southern Rhodesia exceeded the figures for 1959 by only 7,000 head. Slaughterings by private butchers decreased by 3,000 head while that of the Cold Storage Commission increased by 10,000 head. The serious drought conditions were to some extent responsible for heavier slaughterings during 1960. A further result of the poor season is reflected in a significant increase being recorded in the numbers and percentages of the lower grades. Total supplies of beef were well maintained throughout the year. The Cold Storage Commission ensured adequate supplies of high-grade beef for the Christmas market by feeding special consignments of cattle for this period. After agreement with the Rhodesia National Farmers' Union was obtained, certain modifications were made to the grading definitions. The new grading regulations came into operation on the 1st of April, 1960. They provided essentially for a stricter interpretation of ossification in determining age, and allowed for the degrading of certain carcases which were considered excessively coarse and over-fat.

Grading services were extended to Northern Rhodesia on the 1st of January, 1960. Producers were given the option of live grading at six points along the line of rail or carcass grading at Livingstone and Lusaka. Carcass grading will be extended to the Copperbelt when sufficient staff has been appointed and trained.

The Cold Storage Commission slaughtered 3,581 calves, and private butchers 11,658 during the year. At the controlled centres in Southern and Northern Rhodesia 10,865 immature male stock, 9,258 suitable breeding stock, and 1,902 tollies weighing between 100 lb. and 200 lb. c.d.w. were slaughtered. Considerable concern has been expressed in connection with this undesirable practice and widespread propaganda to counteract this waste has been made.

No change has been made in the prices of slaughter cattle and the schedule in operation during the year was published on the 1st of April, 1960, reflecting the same prices which have previously been in operation.

Production and Marketing

In order to stimulate the production of beef, an intensive campaign was launched throughout the country to make producers acquainted with the requirements of the export and local markets. Widespread propaganda was made for better methods of feeding, breeding and management. In order to ensure that the efforts to increase production will be sustained, a beef production drive committee was formed with representatives from all interested parties; to examine and recommend different methods of increasing production for the local and export trade.

A major advance was achieved by the efforts of this committee in completing the details of a new feeder scheme for introduction during the following season. The scheme, which will be financed by the Cold Storage Commission, will enable producers to obtain store cattle for feeding or to purchase feed for feeding their own cattle for the market.

Drought Relief

During January, 1960, officials of the Federal Ministry of Agriculture, in collaboration with the National Farmers' Union, Cold Storage Commission, I.C.A. Organizations and the Native Department made an assessment of drought conditions in Matabeleland. The position was considered sufficiently serious to recommend the immediate implementation of special emergency measures to counteract the effects of the drought. A National Drought Relief Committee was formed with headquarters in Salisbury and a Livestock Drought Committee in Bulawayo. Wide powers were given to these committees to advise Government and to take such steps as became necessary to deal with the situation.

The main purpose of the livestock drought relief was to ensure that the breeding herds of the country were maintained, and that practical assistance was provided to all producers who found themselves in difficult circumstances as a result of the drought. In order to achieve its objective the facilities of the Cold Storage Commission, Rhodesia Railways, and various Federal and Territorial departments were freely placed at the disposal of the committee. This enabled the committee to purchase slaughter stock and young stock on a priority basis. Boreholes were provided where urgently required. Stock were moved to available crown land grazing. Subsidized hay was provided for dairy farmers. Financial assistance was granted by the Land Bank through loans with special conditions and rates of interest. In addition arrangements were made for special income tax relief measures where producers were forced to sell abnormal numbers of stock as a result of drought conditions.

It can be stated with the utmost confidence that the efforts of the committee successfully assisted to counteract the detrimental effects of the drought on the industry. It is, however, not possible at this stage to indicate to what extent the industry had been affected. The setback may not be as serious as during the 1946-47 drought, but it must be anticipated that the reproduction rates will have been decreased. In many native reserves excessive sales and high mortality rates will certainly affect the number of cattle coming on to the market in the near future. The full impact of the drought will only become evident when the influence of these factors can be evaluated.

During the year the Cold Storage Commission extended its trading operations to Northern Rhodesia. This significant development enabled the long-term system of guaranteed minimum prices previously only applicable to Southern Rhodesia to be available to producers in Northern Rhodesia.

PIGS

It appears as if pig numbers have reached a reasonably stable figure—under present conditions—of prices on markets. The main objective will remain the supply of local requirements while small quantities of special products will be exported.

NUMBER OF PIGS IN THE FEDERATION (in thousands)

Year	Federal State		Southern Rhodesia		Northern Rhodesia		Nyasaland	
	European-owned	African-owned	European-owned	African-owned	European-owned	African-owned	European-owned	African-owned
1955 . .	65	151	53	46	10	30	2	75
1956 . .	65	162	50	47	13	40	2	75
1957 . .	80	188	59	57	18	44	3	87
1958 . .	78	182	58	56	17	46	3	80
1959 . .	79	214	61	47	15	50	3	117

SLAUGHTER OF PIGS OVER THE PAST FIVE YEARS

Year	Federal State	Southern Rhodesia	Northern Rhodesia	Nyasaland
1955 . . .	120,441	102,260	12,697	5,484
1956 . . .	113,205	92,438	15,185	5,582
1957 . . .	118,870	94,332	15,410	6,128
1958 . . .	142,938	113,635	21,069	8,234
1959 . . .	152,670	123,280	25,008	4,382

Pigs slaughtered and graded in the controlled areas of Southern Rhodesia:

A. — COMBINED TOTALS FOR COLCOM PLANTS

Grade	Baconers		Porkers		Cutters	
	Number	%	Number	%	Number	%
A . . .	42,134	80·42	15,849	54·52	1,544	31·09
B . . .	4,904	9·36	4,514	15·53	766	15·42
C . . .	11,11	2·12	—	—	—	—
L . . .	1,467	2·80	276	0·95	37	0·74
X . . .	2,719	5·19	7,605	26·16	2,524	50·82
Inferior .	58	0·11	825	2·84	96	1·93
TOTAL .	52,393	—	29,069	—	4,967	—

Grade	Underweight Pigs		Baconers	Manufacturing Pigs		Boars	
	No.	%	No.	No.	%	No.	%
A	—	—	—	2,928	82·09	292	73·37
B	359	14·70	690	546	15·30	106	26·63
L	50	2·05	—	—	—	—	—
X	1,092	44·72	—	93	2·61	—	—
Inferior	941	38·53	—	—	—	—	—
TOTAL	2,442	—	690	3,567	—	398	—

B. — COMBINED TOTALS FOR PRIVATE BUTCHERS

Grade	Baconers		Porkers		Cutters	
	Number	%	Number	%	Number	%
A . . .	475	21·37	2,406	14·17	513	13·74
B . . .	144	6·48	1,251	7·36	265	7·10
C . . .	47	2·11	—	—	—	—
L . . .	1	0·05	60	0·35	26	0·70
X . . .	1,427	64·19	11,252	66·21	2,674	71·65
Inferior .	129	5·80	2,024	11·91	254	6·81
TOTAL .	2,223	—	16,993	—	3,732	—

Grade	Underweight Pigs		Manufacturing Pigs	
	Number	%	Number	%
A	—	—	615	76·21
B	477	7·31	144	17·84
L	18	0·28	—	—
X	3,559	54·58	—	—
Inferior	2,467	37·83	48	5·95
TOTAL	6,521	—	807	—

During the current year Colcom Products slaughtered 93,527 pigs in Southern Rhodesia compared with 93,396 the previous year, while private butchers also reduced slaughterings by a small number from 30,426 to 30,276. Grading commenced in Northern Rhodesia on 1st January, 1960, and during the first nine months Colcom Products slaughtered 7,028 and private butchers 2,543 pigs. No changes were made in the grading system during the year. Minor alterations in the price structure provided for the removal of the maximum price bracket from X and inferior grades in all classes of pigs. At the same time retail prices of grade 3 and 4 pork were raised to a maximum of 2s. and 1s. respectively.

A Producers' Co-operative was formed in Northern Rhodesia. This organization became a member of Colcom Products Ltd., who started trading in Northern Rhodesia in January.

The new Pig Industry Act for the establishment of a Federal Pig Industry Board was passed by the Federal Assembly and the new Board commenced operations on the 1st of February, 1960. This will enable the production and marketing of the pigs to be organized on a federal basis.

Another important development during the current year has been the commencement of building operations on a new modern bacon factory in Salisbury. The marketing of African produced pigs remains a problem in the industry. Efforts to evolve a common system of marketing for all pigs produced in the country were made during the year without success. The wide differences in the prices of lower and higher grade pigs resulted in buyers paying consistently higher prices than those gazetted by Government. Consequently a large measure of temptation was created for evading retail prices as laid down for 3rd and 4th grade pork. It is considered highly desirable that methods should be considered to increase the extremely low levels of pig meat consumption as well as to investigate alternative methods of utilization in order to offer a greater variety of pig products to local consumers.

Progeny Testing

There has been a steady increase in the support received for the progeny testing scheme. The position has been reached where a growing number of boars have had three litters or more tested. This enabled commercial breeders to benefit by now having pigs of tested breeding value from which to select their breeding stock. As a result of the high standards required for entry 51 per cent. of the 191 applications were disallowed for various reasons. The majority of cancellations were due to the inability to conform with the minimum litter size at weaning. Detailed results of the scheme are regularly published in the Rhodesia Agricultural Journal. The following table gives a summary of the main results obtained for the different breeds:—

		Large White	*Landrace*
Age in days at slaughter		195·4	198·1
Gain per day		1·45	1·39
Feed conversion		3·30	3·48
Length of carcase, mm.		811·6	836·6
Backfat thickness	Shoulder, mm.	41·8	38·0
	Middle, mm.	21·8	22·1
	Rump, mm.	26·4	24·6

SHEEP

Sheep production is increasing at a reasonably steady rate as indicated by the following figures. A substantial increase has taken place in the numbers of European-owned sheep in Southern Rhodesia. With intensification of farming and the expansion of planted pastures further development can be expected in this field.

NUMBER OF SHEEP OVER THE LAST FIVE YEARS
(*in thousands*)

Year	Federal State		Southern Rhodesia		Northern Rhodesia		Nyasaland	
	European-owned	African-owned	European-owned	African-owned	European-owned	African-owned	European-owned	African-owned
1955 . .	118	239	106	145	9	18	3	76
1956 . .	130	210	118	124	9	22	3	64
1957 . .	143	202	130	118	10	29	3	55
1958 . .	159	228	146	144	11	24	2	60
1959 . .	176	248	161	154	12	22	3	72

In the past the general quality of mutton produced in the country has generally been of a fairly poor standard. With the intensification of sheep production in some areas it was felt necessary to implement measures which will encourage the production of better quality mutton and lamb. As a result of negotiations between producers the Cold Storage Commission and Government a grading system for sheep was introduced to provide the necessary stimulus for this purpose

It was not considered necessary to introduce any price system at the same time. Prices for the various grades were considered should be a matter of negotiation between producers and the Cold Storage Commission, until such time as the market demand has given more specific guidance as to the type of mutton and lamb required and the prices which the consumers will be prepared to pay.

GENERAL

The commencement of the marking system for quality rations introduced by the Rhodesia and Nyasaland Standard Association received widespread support and is having a beneficial effect on the quality of livestock rations sold in this country.

Close co-operation was maintained with other departments and extensive advisory functions were performed, including numerous cattle courses and specialists visits to farms.

THE DAIRY INDUSTRY

R. G. JONES, *Chief Dairy Officer*

DAIRYING SEASON

The salient feature about this season has been the drought conditions in many areas and erratic rainfall in some others. The main areas where dairying was affected by the drought were Bulawayo and Gatooma. Owing to the early ending of the previous wet season dairy farmers had to provide supplementary feeding for an extended period and this created serious difficulties in some cases. The fact that even in areas affected by drought conditions milk production increased indicates that dairy farm management has advanced to a stage where milk production is becoming far less dependent on seasonal conditions. Climatic vagaries will always affect food production for dairy cattle and the economics of production but these can be minimized by careful planning and proper storage facilities.

PRODUCTION OF DAIRY PRODUCE

Preliminary figures indicate that overall milk production increased by one million gallons in Southern Rhodesia and half a million gallons in Northern Rhodesia as compared with the previous year. Milk supplies to the Dairy Marketing Board increased by 11.6 per cent. (1,436,000 gallons) and milk supplies to the Co-operative Creameries of Northern Rhodesia increased by 7.3 per cent. (209,000 gallons). The development of the industry continues in the direction of an increase in the sale of whole-milk off farms to one or other of these organizations through which the producer price agreement operates.

As whole-milk sales fell slightly in Southern Rhodesia and increased only slightly in Northern Rhodesia the main problems of the marketing organizations continue to be concerned with the disposal of milk surplus to whole-milk requirements. The producer price agreement guarantees a price to producers for milk used for whole-milk plus a safety margin and any supplies in excess of this is paid for at realization value. The marketing organizations are making strenuous efforts to maintain a reasonable blend or pool price by increasing sales of skim-milk—both sweet and sour—to Africans in the urban areas.

Cheese manufacture continues to be the largest outlet for surplus milk, followed by skim-milk powder manufacture at the Dairy Marketing Board dairy at Gwelo. Over 420 tons of Cheddar and Gouda cheese was exported from Northern and Southern Rhodesia in the first half of the year under review when world prices were comparatively high, but when these prices fell sharply an effort was made to curtail production to match local requirements with a consequential increase in skim-milk powder production.

Nestlés started the construction of their dried-milk factory in Salisbury at the end of 1959 and this factory should be in operation before the end of 1960. It is anticipated that the manufacture of whole-milk powder by Nestlés will absorb over one and a quarter million gallons of milk per annum once the factory is in full production.

The Dairy Marketing Board has arranged to instal spray drying plant at the Gwelo factory to produce spray-dried skim-milk powder in addition to roller-dried. It had been expected that this plant would have been in operation in September, 1960, but owing to delay in delivery of certain items this was not possible and it is unlikely that spray-dried skim-milk powder will be produced until the second half of November.

Production figures for the main commodities are given in Tables I and II for Southern and Northern Rhodesia respectively. These figures do not include butter and cheese produced on farms, which is relatively very small.

Table I

DAIRY PRODUCTION 1920–1959 — SOUTHERN RHODESIA

Year	Butter 1,000 lb.	Cheese 1,000 lb.	Skim-milk Powder (*b*) 1,000 lb.	Liquid Milk (*a*) 1,000 gals.	Total gallons
1920 . . .	600	79	—	258	2,000,000
1930 . . .	1,768	163	—	1,008	6,100,000
1940 . . .	1,686	383	—	2,095	6,910,000
1945 . . .	1,224	702	—	3,848	7,750,000
1950 . . .	900	394	—	5,720	9,000,000
1955/56 . .	1,083	2,168	—	8,050	13,202,000
1956/57 . .	1,387	2,050	137	9,100	14,900,000
1957/58 . .	1,437	2,240	438	9,600	15,700,000
1958/59 . .	1,881	2,693	934	9,700	17,400,000
1959/60 (*c*) .	2,354	2,879	1,504	9,400	18,400,000

(*a*) Milk available for use as liquid milk, skim-milk, fresh cream and ice-cream.
(*b*) Production of skim-milk powder started during 1956/57.
(*c*) Preliminary figures.

Table II

DAIRY PRODUCTION 1956–1959 — NORTHERN RHODESIA

Year	Butter 1,000 lb.	Cheese 1,000 lb.	Liquid Milk (*a*) 1,000 gallons	Total gallons
1956/57	40	497	1,750	2,400,000
1957/58	56	426	2,330	3,000,000
1958/59	129	851	2,700	4,000,000
1959/60 (*b*) . . .	231	745	3,090	4,500,000

(*a*) Milk available for use as liquid milk, skim-milk, fresh cream and ice-cream.
(*b*) Preliminary figures.

The only factories operating outside the orbits of the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia are the Gazaland Co-operative Cheese Factories in Chipinga, E.M.C.O. Creamery in Umtali and the Zambesi Co-operative Dairies in Livingstone. Production of the Gazaland Co-operative Cheese Factory was approximately 7 per cent. more than in the previous year. The E.M.C.O. Creamery in Umtali produced more butter than was required to meet the demand in the Eastern Districts and some of this Creamery's butter was sent to Salisbury for disposal by the Dairy Marketing Board. Milk supplies to the Zambesi Co-operative Dairies at Livingstone increased by approximately 12 per cent. as compared with the previous year.

Tables III and IV show the approximate numbers of suppliers and total intake of milk in recent years of the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia.

Table III

THE DAIRY MARKETING BOARD — SOUTHERN RHODESIA

Year	*Number of Suppliers (August)*	*Total Milk Supplied (gallons)*
1955/56	403	8,852,000
1956/57	416	9,736,000
1957/58	459	10,794,000
1958/59	522	12,379,000
1959/60	531	13,815,000

Table IV

THE CO-OPERATIVE CREAMERIES OF NORTHERN RHODESIA

Year	*Number of Suppliers (August)*	*Total Milk Supplied (gallons)*
1955/56	118	1,431,000
1956/57	125	1,880,000
1957/58	123	2,211,000
1958/59	135	2,867,000
1959/60	137	3,076,000

From these figures it is clear that the trend of increased average production per supplier continues. Although a number of new suppliers commenced production during the year approximately an equal number went out of production resulting in a very small increase in numbers as compared with previous years.

Creameries, Butter Production and Consumption

Butter was manufactured by the four main creameries situated at Lusaka, Salisbury, Gwelo and Umtali and a small quantity for the local demand by the Zambesi Co-operative Dairies at Livingstone. A small quantity of butter was produced on farms in the remote areas. All importation of butter was done by the Dairy Marketing Board in Southern Rhodesia and by the Co-operative Creameries in Northern Rhodesia.

The increase in butter production during the period can be attributed directly to increased supplies of milk to the main organizations and the consequent utilization of surplus milk for skim-milk sales and the manufacture of skim-milk powder at Gwelo.

Tables V and VI give the production and apparent consumption of butter in Southern and Northern Rhodesia respectively and show that the trends over the last few years have been continued.

TABLE V

PRODUCTION AND APPARENT CONSUMPTION OF BUTTER
SOUTHERN RHODESIA

Year	*Production* 1,000 *lb.*	*Consumption* 1,000 *lb.*	*Shortfall met by importation* 1,000 *lb.*
1950/51	767	2,643	1,876
1955/56	1,083	3,650	2,567
1956/57	1,398	3,997	2,599
1957/58	1,445	3,800	2,355
1958/59	1,881	3,545	1,664
1959/60 (*a*)	2,354	3,430	1,076

(*a*) Preliminary figures.

TABLE VI

PRODUCTION AND APPARENT CONSUMPTION OF BUTTER
NORTHERN RHODESIA

Year	*Production* 1,000 *lb.*	*Consumption* 1,000 *lb.*	*Shortfall met by importation* 1,000 *lb.*
1956/57	44	1,678	1,634
1957/58	65	1,532	1,467
1958/59	129	1,422	1,293
1959/60 (*a*)	231	1,346	1,115

(*a*) Preliminary figures.

Butter was imported from Kenya and South Africa in the following proportions:

	Southern Rhodesia per cent.	*Northern Rhodesia per cent.*	*Total per cent.*
Kenya	12·9	59·2	37·2
South Africa	87·1	40·8	62·8

A small quantity of butter was exported to Portuguese East Africa during the year and most of Nyasaland's butter requirements were supplied from Southern Rhodesia and are included in the consumption figures for Southern Rhodesia.

There was a substantial rise in world butter prices at the time arrangements were made for butter imports for this period and this resulted in an increase of 5d. per lb. in the retail price of butter at the beginning of January, 1960. Maximum retail prices for butter in Northern and Southern Rhodesia for the period were as follows:

	1st Grade per lb.	*2nd Grade per lb.*
1st October, 1959, to 31st December, 1959	3s. 8d.	3s. 6d.
1st January, 1960, to 30th September, 1960	4s. 1d.	3s. 11d.

A significant change was made in butterfat prices by the implementation of the Agricultural Marketing Council's recommendation to decrease the seasonal difference in minimum prices paid for butterfat by creameries. From 1st January, 1960, summer prices were increased by 6d. per lb. in Southern Rhodesia and winter prices reduced by the same amount, which is estimated to result in approximately the same average price paid by creameries. At the same time the butterfat prices for Northern Rhodesia were brought into line with those in Southern Rhodesia.

Minimum prices for butterfat supplied as cream to creameries from 1st January, 1960, in both Territories are:

	1st Grade per lb.	*2nd Grade per lb.*
January to March	3s. 6d.	3s. 3d.
April and December	3s. 10d.	3s. 7d.
May to November	4s. 2d.	3s. 11d.

There is no price control on other grades of butterfat and butter.

All butter is graded before sale in Southern Rhodesia but there is no such statutory requirement in Northern Rhodesia although Dairy Officers have carried out check grading from time to time for advisory purposes in that Territory.

Tables VII and VIII give the grades of butter manufactured as percentages of total production.

TABLE VII

BUTTER GRADES AS PERCENTAGE OF TOTAL MANUFACTURE
SOUTHERN RHODESIA

Year	*First Grade per cent.*	*Second Grade per cent.*	*Third Grade per cent.*
1955/56 . . .	86·6	9·8	3·6
1956/57 . . .	87·2	8·6	4·2
1957/58 . . .	87·0	9·0	4·0
1958/59 . . .	88·0	9·0	3·0
1959/60 . . .	92·0	6·0	2·0

TABLE VIII

BUTTER GRADES AS PERCENTAGE OF TOTAL MANUFACTURE
NORTHERN RHODESIA

Year	*First Grade per cent.*	*Second Grade per cent.*	*Third Grade per cent.*
1956/57 . . .	96·0	1·0	3·0
1957/58 . . .	96·0	3·0	1·0
1958/59 . . .	888·0	1·0	11·0
1959/60 . . .	84·0	—	16·0

The increase in percentage of first-grade butter produced in Southern Rhodesia is largely due to the fact that increased production is from fresh cream.

Most of the margarine containing 10 per cent. butter used in the Federation was manufactured in Salisbury and locally manufactured butter was used in this commodity.

Cheese Factories, Cheese Production and Consumption

Eight cheese factories were registered and operated during the year. Unfortunately the Italo-Rhodesian Cheese Factory Ltd., in Salisbury, ceased production in September, 1959, and is therefore not included in the eight factories referred to above.

The Gazaland Co-operative Cheese Factories Ltd. operated their factory at Chipinga where Cheddar and a small amount of Gouda cheese was manufactured. Factories at Umtali, Salisbury, Gwelo and Bulawayo, operated by the Dairy Marketing Board, manufactured Cheddar and Gouda cheese and the Board's factory at Gatooma produced a small quantity of Roquefort cheese.

In Northern Rhodesia the Co-operative Creameries produced Cheddar and Gouda cheese at their Mazabuka factory and some Gouda cheese at their Broken Hill factory.

Cheddar and Gouda cheese production exceeded the local demand in the Federation and about 422 tons were exported to South Africa. Of this amount 262 tons of Cheddar and 118 tons of Gouda were exported from Southern Rhodesia and 42 tons of Cheddar were exported from Northern Rhodesia. Small quantities of cheese were exported to neighbouring territories and Nyasaland was supplied from Southern Rhodesia.

Once again the Dairy Marketing Board was successful in winning a number of awards for cheese exhibited at the Rand Easter Show.

All Cheddar cheese is graded by Dairy Officers before sale in Southern Rhodesia. There is no such statutory requirement in Northern Rhodesia but the quality of the cheese manufactured in that Territory was checked by Dairy Officers regularly and all cheese exported was graded before despatch.

Table IX shows the percentage of each grade of Cheddar cheese manufactured and graded in Southern Rhodesia in recent years.

TABLE IX

CHEDDAR CHEESE GRADINGS AS PERCENTAGE OF TOTAL CHEESE GRADED IN SOUTHERN RHODESIA

Year	*First Grade*	*Second Grade*	*Third and Below Grade*
1955/56 . . .	94·9	4·2	0·9
1956/57 . . .	96·1	3·5	0·4
1957/58 . . .	97·3	2·4	0·3
1958/59 . . .	93·6	6·1	0·3
1959/60 . . .	96·1	3·6	0·3

The quantity of farmhouse cheese produced was small and only one farmer manufactured Cheddar cheese. This farmer and the Gazaland Co-operative Cheese Factory at Chipinga were paid a special subsidy of 6d. per lb. on cheese produced. This subsidy amounted to about £4,500 for the year under review.

The estimated consumption of cheese in the Federation during the period under review was 3,183,000 lb. Production during the period was 3,624,000 lb. and about 527,000 lb. was imported. No Cheddar or Gouda cheese was imported and this figure for imported cheese refers to various exotic varieties and processed cheeses. Although some Roquefort and processed cheese was produced by the Dairy Marketing Board the quantities were very small in comparison with the main types.

Wholesale and retail prices of cheese remained unchanged and the maximum retail price for first-grade Cheddar and Gouda cheese was 2s. 11d. per lb. in Southern Rhodesia and 3s. 6d. per lb. in Northern Rhodesia.

Milk Supplies and Milk Prices

The industry has followed the same trend as in previous years and the increased production of milk is reflected in the intake figures of the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia. As mentioned previously in this report, sales of whole-milk fell slightly in Southern Rhodesia and increased very little in Northern Rhodesia. Tables X and XI show the milk intake of these organizations and the quantity of milk used by them to meet local requirements of whole-milk.

TABLE X

DAIRY MARKETING BOARD — SOUTHERN RHODESIA

Year	*Total Milk Intake* 1,000 gals.	*Apparent Consumption as Whole-milk* 1,000 *gals.*	*Surplus over Whole-milk Requirements* 1,000 *gals.*
1955/56 . . .	8,852	6,388	2,464
1956/57 . . .	9,736	6,654	3,082
1957/58 . . .	10,794	7,158	3,636
1958/59 . . .	12,379	7,348	5,031
1959/60 . . .	13,815	7,178	6,637

TABLE XI

CO-OPERATIVE CREAMERIES OF NORTHERN RHODESIA

Year	*Total Milk Intake* 1,000 *gals.*	*Apparent Consumption as Whole-milk* 1,000 *gals.*	*Surplus over Whole-milk Requirements* 1,000 *gals.*
1956/57 . . .	1,880	1,315	565
1957/58 . . .	2,211	1,635	576
1958/59 . . .	2,867	1,656	1,211
1959/60 . . .	3,076	1,711	1.365

Milk surplus to whole-milk requirements is disposed of as skim-milk (sweet and sour) in liquid form or manufactured into cheese or skim-milk powder. Sterilized milk is also produced but the quantities used for this purpose are relatively very small. It is clear from the figures given above that owing to the increasing surplus over whole-milk requirements and the relatively lower price obtainable for this surplus compared to whole-milk, actual producer prices have fallen significantly.

There has been no change in milk prices during the year. The producer price agreement was extended for another year and the guaranteed producer price which applies to milk used to meet whole-milk demand plus a safety margin was not changed although according to the accepted cost of production indices the cost of production had increased.

Tables XII and XIII show the standard prices and actual average payout prices as calculated without applying the individual effect on producer prices of the payment on quality scheme. The standard prices in Southern and Northern Rhodesia are the same and the differences in actual prices paid in each territory is due to the fact that two separate pools operate which results in different proportions of surplus to whole-milk as well as different values of surplus milk. These prices refer to milk purchased by the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia.

TABLE XII

SOUTHERN RHODESIA

Month	*Standard Price per gallon*	*Actual Average Payout Without Quality Payment per gallon* (*a*)	*Actual Average Payout Without Quality Payment per gallon* (*b*)
	1959/60	1959/60	1958/59
October . . .	4s. 3d.	3s. 3·8d.	3s. 6·8d.
November . .	4s. 3d.	3s. 3·1d.	3s. 4·4d.
December . .	3s. 1d.	2s. 4·9d.	2s. 6·2d.
January . . .	3s. 1d.	2s. 4·6d.	2s. 6·3d.
February . .	3s. 1d.	2s. 5·2d.	2s. 7·9d.
March . . .	3s. 11d.	2s. 11·5d.	3s. 3·1d.
April	3s. 11d.	3s. 0·1d.	3s. 4·2d.
May	3s. 11d.	2s. 11·5d.	3s. 3·6d.
June	3s. 11d.	3s. 0·3d.	3s. 3·7d.
July	4s. 3d.	3s. 2·8d.	3s. 5·3d.
August . . .	4s. 3d.	3s. 2·5d.	3s. 4·2d.
September . .	4s. 3d.	3s. 2·3d.	3s. 3·4d.

(*a*) Prices subject to adjustment when actual average realization value of surplus milk is established by the Dairy Marketing Board.

(*b*) Prices to June include supplementary payment on surplus milk.

TABLE XIII

NORTHERN RHODESIA

Month	*Standard Price per gallon*	*Actual Average Payout Without Quality Payment per gallon*	*Actual Average Payout Without Quality Payment per gallon*
	1959/60	1959/60	1958/59
October . . .	4s. 3d.	3s. 6·05d.	3s. 6d.
November . .	4s. 3d.	3s. 5·21d.	2s. 9·75d.
December . .	3s. 1d.	2s. 2·55d.	2s. 0·4d.
January . . .	3s. 1d.	2s. 4·33d.	2s. 6·1d.(*a*)
February . .	3s. 1d.	2s. 4·07d.	2s. 7·5d.
March . . .	3s. 11d.	2s. 11·70d.	3s. 3·4d.
April	3s. 11d.	3s. 0·17d.	3s. 2·9d.
May	3s. 11d.	3s. 1·18d.	3s. 2·2d.
June	3s. 11d.	3s. 0·90d.	3s. 1·2d.(*b*)
July	4s. 3d.	3s. 3·89d.	3s. 3·1d.
August . . .	4s. 3d.	3s. 2·37d.	3s. 3·2d.
September . .	4s. 3d.	3s. 4·25d.	3s. 5·7d.

(*a*) Prices aligned with prices in Southern Rhodesia.

(*b*) "Safety margin" increased from 20,250 gallons to 20,800 gallons per month.

There were no changes in retail prices for milk during the period under review. These prices are controlled by a prices order in Southern Rhodesia in areas within seven miles of the main post offices in the main towns but there is no such legal control in Northern Rhodesia although, where subsidies are involved, the prices are agreed with Government.

Retail prices for cash sales are as follows:

Southern Rhodesia: 8d. per pint.

Northern Rhodesia: Copperbelt, 9½d. per pint; Midlands, 8½d. per pint.

On 1st July, 1960, the Dairy Marketing Board put "Channel Island" milk on the market in Salisbury at 9d. per pint. The premium obtained, less the additional costs of the Board, is passed to the producers of this milk. At the end of the year "Channel Island" milk accounted for about 5 per cent. of whole-milk sales in Salisbury.

As far as can be ascertained retail prices for milk sold by producer retailers outside the price controlled areas in Southern Rhodesia remained at the same level as last year. The retail prices charged by the Zambesi Co-operative Dairies in Livingstone and the Gazaland Co-operative Cheese Factories in Chipinga remained unchanged.

The Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia continued their efforts to increase sales of milk and dairy products by advertising campaigns, etc., particularly directed towards Africans. Although it is not possible to establish accurate figures of sales of milk to Africans it is clear that these are increasing. The main increase is in sales of sour skim-milk in urban African areas. It is hoped that with still greater efforts and the co-operation of the responsible authorities milk consumption by the African community will increase substantially and this will benefit both the Africans themselves and the dairy industry.

Fresh Cream

The demand for fresh cream was met by the main dairies and producer retailers. No statistics of fresh cream sales are available and no reliable estimate of consumption can be made.

Dried Milk

Production of dried skim-milk by the Dairy Marketing Board at the Gwelo factory increased by over 50 per cent. to over 1½ million lb. The manufacture of skim-milk powder has now become a very important factor in the development of the dairy industry and the Board is installing spray drying equipment at this factory. It is anticipated that this new plant as well as the roller driers will be able to meet the full demand for skim-milk powder next year. The main bulk of the production is sold in wholesale quantities in paper bags but sales of 1 lb. packets, mainly in rural African areas, also takes place.

The Nestlés dried-milk factory which is being erected in Salisbury is nearing completion and should be in operation early in December, 1960. This factory will produce dried whole-milk and will be an important factor in the industry.

Sterilized Milk

The production of sterilized milk was continued in Bulawayo and Lusaka. Sterilized flavoured skim-milk was produced in addition to sterilized whole-milk. It appears that the demand for sterilized milk is limited and there has not been much expansion in sales although the Dairy Marketing Board's sales to Nyasaland have increased.

Dairy Bonus Scheme

This scheme, which operates only in Southern Rhodesia, was continued as in the previous year. Consideration was given to the desirability of continuing this scheme in its present or in a modified form and certain recommendations have been made but no decision was reached before the end of the period under review. Special conditions are applied in the Chipinga area in relation to milk supplies to the cheese factory and £5,143 was paid in bonuses on this milk. The bonus paid on butterfat amounted to £7,584.

GENERAL

Owing to a very substantial increase in milk production with little or no increase in whole-milk sales the producer price paid per gallon of milk supplied to the Dairy Marketing Board and the Co-operative Creameries of Northern Rhodesia through which the producer price agreement operates has fallen significantly. Various suggestions have been made to limit production such as the imposition of quotas but no acceptable alternative to the present pricing arrangement has been put forward so far. It is hoped that by making milk more readily available in African urban areas through the Dairy Marketing Board depots situated in those areas an increased consumption by Africans will be brought about. Present indications are that the main increase in sales to Africans will be in the form of cultured skim-milk for some time to come.

In order to assist producers in areas affected by drought the March standard price was used in the calculation of milk prices for January and February in respect of those farmers situated in certain specified drought stricken areas around Bulawayo and Gatooma. This resulted in these producers receiving about 5d. per gallon more for milk supplied than they would have received using January and February standard prices and this additional amount was met by a special subsidy.

The new dairy at Salisbury was completed and brought into operation at the end of April, 1960, when it was officially opened by Mr. J. R. Corry, the retiring Secretary to the Ministry of Agriculture, and a former Chief Dairy Officer. When this factory was designed it was anticipated that the Nestlés dried-milk factory would absorb all surplus milk in Salisbury, but this factory is not yet in operation and also milk supplies have increased more than was expected so that it is still necessary for the Dairy Marketing Board to provide manufacturing facilities for milk in Salisbury. For the time being cheese-making and storage has to be continued at the old Saisbury Dairy and butter-making and ice-cream manufacture continues at the Salisbury Creamery which the Board leases from the Farmers' Co-operative Industries. The Board, therefore, operates three establishments in Salisbury but it is hoped that it will be possible for it to extend the new dairy to absorb all its manufacturing activities in the near future.

Structural alterations were carried out at the Mazabuka dairy and the layout of plant was changed to provide additional space for cheese manufacture. Limited facilities for the manufacture of Gouda cheese were provided at the Broken Hill dairy.

The increased demand for milk in various forms on the Copperbelt necessitated an increase in tanker transport of milk from the Midlands area of Northern Rhodesia and a 500-gallon tanker trailer was used to increase the transport facilities from Broken Hill to Kitwe. The Dairy Marketing Board will introduce tanker transport of milk from the Salisbury dairy to the Nestlés factory and possibly from Gatooma to Gwelo during the next few months.

The Zambesi Co-operative Dairies Limited are considering the installation of pasteurizing and related equipment so that they can supply pasteurized milk in Livingstone. It is hoped that it will be possible to instal suitable equipment in this dairy in the near future.

Exports of pasteurized milk from Umtali to Portuguese East Africa continued at approximately the same level as the previous year. Most of this milk is consumed in Beira.

Messrs. J. Lyons and Co. started manufacturing ice-cream in Salisbury during the year.

Some negotiations took place for the take-over of the Co-operative Creameries of Northern Rhodesia Limited by the Dairy Marketing Board but no decision had been reached by the end of the period under review. If this comes about legislation will have to be introduced and the Dairy Marketing Board will have to be reconstituted.

Little progress has been made in the preparation of a Federal Dairy Act and in initial draft had not been completed by the end of the year under review. Amendments were made to the Dairy Regulations in Southern Rhodesia to provide for the sale of only pasteurized, sterilized and tuberculin tested milk in the main centres and also the introduction of a more comprehensive schedule of standards of composition for dairy produce. These amendments come into effect on 1st January, 1961.

Samples of milk from the various dairies were collected quarterly and dried at Gwelo. The resultant powder was sent to the United Kingdom for the estimation of radio-active fallout but no results have yet been obtained.

MILK RECORDING

There were a number of developments in connection with the Milk Recording Scheme during the year under review.

The Dairy Officer in charge of the scheme spent three months in the United Kingdom studying methods of assembling and analysing lactation records at the Production Division of the Milk Marketing Board at Thames Ditton, the Scottish Bureau of Milk Records at Edinburgh and the Scottish Milk Recording Association in Ayr. As a result of the information gained he made a number of recommendations for improving the efficiency of the scheme operated in Rhodesia. A Milk Records Advisory Committee was set up by the Minister to consider these recommendations and to assist in policy matters relating to the Milk Recording Scheme.

Changes have been made in the methods of sampling of milk in the official section of the scheme and in the methods of calculating lactation average butterfat percentages. Advantages from these changes have already become apparent.

Other changes have been agreed to and are to be introduced as soon as practicable. These concern the identification of cattle by earmarking, new lactation sheets involving photo-copying and reducing clerical work at head office. It is hoped that the necessary photo-copying machine may be ordered soon and that a change in stationery can be introduced early in 1961.

A more comprehensive set of rules for the scheme has been prepared and considered by the committee and it is anticipated that these will be finalized and introduced in the near future.

It is an unfortunate aspect of the Milk Recording Scheme that its scope is limited strictly by the number of Milk Recorders that can be employed. A further complication is that in order to keep costs at a minimum the country has to be split up into areas which sometimes results in a position where a Milk Recorder in one area could cope with additional herds while in another area a long way away there is a waiting list of farmers wishing to join the scheme. At the end of the year there was a waiting list in Manicaland and Mashonaland, Midlands was full and there were a few vacancies in Matabeleland, whilst in Northern Rhodesia a number of farmers have dropped out of the scheme and only 21 herds were being recorded.

The leading herd in the "A" Section of the Milking Competition had an average production for its best 15 cows of over 17,000 lb. of milk which is 2,000 lb. more than the previous best in this competition and indicates the standards that can be achieved.

Tables XIV and XV give the prodction figures for the winners of the Milking Competitions and average production per cow recorded, respectively, in recent years.

TABLE XIV

PRODUCTION OF WINNING HERDS IN MILKING COMPETITIONS
AVERAGE OF BEST 15 COWS IN THE HERD

Year	*Milk Section (A)*	*Butterfat Section (B)*
1954/55	13,772 lb.	496·6 lb.
1955/56	14,551 lb.	486·1 lb.
1956/57	14,908 lb.	511·9 lb.
1957/58	14,863 lb.	503·6 lb.
1958/59	17,153 lb.	592·3 lb.

TABLE XV

AVERAGE PRODUCTION PER COW — PEDIGREE AND GRADE HERDS

Year	Completed Lactations	Average Milk Production per Cow	Average Butterfat Production per Cow	Percentage of Butterfat	Days
1954/55 . .	7,330	6,415	246·9	3·85	280
1955/56 . .	8,095	6,400	250·5	3·91	277
1956/57 . .	9,050	6,683	257·7	3·86	286
1957/58 . .	9,783	6,674	260·5	3·79	277
1958/59 . .	11,432	6,674	270·7	4·06	277

With the introduction of changes in methods of assembling information it is hoped that it will be possible to introduce mechanized analysis of records. Discussions on these matters have taken place with other Government Departments which have suitable machines which could be used.

DAIRY BRANCH ACTIVITIES

The work of the Branch includes statutory inspections and registration of factories and farm dairies in both Northern and Southern Rhodesia, grading of dairy produce and testing of milk and dairy products, advisory work on production of milk and manufactured products, lecturing at Gwebi Agricultural College, judging of dairy produce at Agricultural Shows and operating the Milk Recording Scheme. In addition lectures were given on special aspects of dairying at short courses run by the Department of Conservation and Extension. The Chief Dairy Officer made a short survey of the dairy industry in the Southern part of Nyasaland and judged dairy produce at the Rand Easter Show.

With the growth of the dairy industry the work of the Branch increases and in spite of the fact that the Branch was brought up to full established strength by the appointment in November, 1959, of Mr. T. M. Morris as a Dairy Officer, it has been extremely difficult to cope with all demands.

The disposition of the staff was the same as in the previous year with two Dairy Officers and one Milk Recorder stationed in Lusaka, one Dairy Officer and one Milk Recorder at Gwelo, two Milk Recorders at Bulawayo, one Milk Recorder at Umtali and the remainder of the staff at Salisbury.

The scheme for the payment for milk on a quality basis takes up an increasing amount of Dairy Officers' time. Over 16,000 samples of milk were tested during the year for the purposes of this scheme and numerous other advisory and special tests were done to investigate problems. Special arrangements were made for testing milk of individual cows over an extended period at Grasslands Research Station in connection with a research project on feeding of dairy cattle.

All meetings and sub-committee meetings of the Dairy Marketing Board were attended by the Chief Dairy Officer or his deputy and numerous other meetings of farmers' organizations were attended by officers of the Branch.

Every effort has been made to meet all demands made upon the Branch and to maintain a high level of efficiency. The loyal and willing co-operation of all officers and staff in meeting the demands made upon them is deeply appreciated.

POULTRY

G. H. COOPER, *Chief Poultry Officer.*

INTRODUCTION

Whilst poultry are not affected directly as are ruminants by seasonal drought conditions, yet indirectly they may be affected on mixed farms by restrictions on feed or capital expenditure for development. The low and rather erratic rainfall during the crop growing season therefore has not shown any marked effect on poultry production to date. However, apart from the Copperbelt where production lagged behind consumption, there has been no general expansion. In keeping with most enterprise, political uncertainty has probably influenced poultry producers to adopt a "wait and see" attitude though the price factor has had most influence in this respect.

PRODUCTION

All internal markets have been fully supplied with local poultry products —even somewhat to excess at times—and the necessity to import removed with the exception of some turkeys for the Christmas trade.

EGGS

The available statistics show no change in numbers of laying stock or eggs sold from last year. Values have been somewhat lower and feed costs higher, therefore the margin available to producers has been less and where efficiency has not been high financial losses have occurred.

The large poultry population unrecorded in urban areas renders statistics unreliable and the generally lower average prices this year indicate that production has in fact been higher than shown.

The seasonal pattern of egg production was less marked this year with higher winter production, resulting in a more even price throughout the year. Prices did, however, drop heavily in the spring as usual but have recovered somewhat to about cost of production point. Producers rearing replacement stock at this time will not be able to pay for all the feed required from egg receipts alone.

The average producer price for the year over all areas except the Copperbelt has been approximately 3s. 3d. per standard dozen, with only four months above the average. It will be seen therefore that unless a producer obtained high production in those months it would be impossible to make a profit as the producer price was actually on or below calculated cost of production of 2s. 9d. per dozen during five months of the year.

Producers on the Copperbelt where producer prices have been 4s. to 4s. 6d. per standard dozen and those elsewhere with contracts at 3s. 9d. to 4s. per standard dozen have received satisfactory returns, but very many producers selling through wholesalers and retailers at market rates have received very poor returns.

Producer egg prices are subject to several influences beyond their control which have a depressing effect. The first is the very considerable domestic production which is carried on in urban areas nominally to ensure fresh eggs for the household but which also supplies large quantities to other consumers. Generally the cost of production is discounted by such producers as it is carried out to provide fresh eggs—which are not always available from retailers—or as a hobby to provide eggs, poultry, and manure for gardens. The second reason is the high retailer margin demanded which would appear to be out of proportion to the risks and costs involved. Most retailers are requiring 9d. per dozen on all eggs regardless of price and some even 1s. per dozen and charging the producer for the carton. Some adjustment in this aspect of marketing appears necessary or there may be a breakdown in supplies through these channels. These influences on the producer price are likely to have a considerable effect on sources of production. The tendency is for production to be increased in and around urban areas and for direct sales to be made to consumers, thereby providing the fresh egg required and also eliminating the retailer in many instances.

Egg grading recommendations were published as a Government Notice in Federal Notice No. 102 of 1960 and it is gratifying to note that more and more eggs are being sold on these grades.

Eggs are marketed through wholesalers, retailers by contract, and direct to consumers. Owing to the difficulties wholesalers have in providing consumers with a really fresh egg and the mark up required as indicated previously there is a marked trend for more supplies to be sold through contracts or direct sales by "on the spot" producers.

The outlook therefore for the egg producer in districts away from markets is not bright unless costs of production can be appreciably lowered. Producers, in order to supply fresh eggs, should supply the nearest market outlet, for if consumers can be assured of good quality eggs at all seasons many will not trouble to keep their own backyard stock.

Improved stock, environment, and efficiency in production are being forced on producers by low margins, but producers are not likely to increase outlay unless they can see the possibility of a reasonable return. There may well be a period of erratic production and prices.

Owing to the risk of storage and low winter prices practically no shelled eggs are cold stored. Pullet eggs and cracks are pulped to supply bakers' requirements in the larger centres.

Table Poultry

The production of broilers has apparently reached saturation point for the present. Retailers were fully stocked during most of the year and producer prices have fallen from 3s. 6d. per lb. to 3s. and 2s. 9d. Competition is very keen and attractive packaging important for retail sale.

Producers, to be successful, must be near the market and either produce up to 100 broilers per week usually employing domestic labour at little extra cost, or they must produce enough to warrant full-time labour and have mechanical equipment (pluckers, etc.). Production is therefore divided between these two categories of producers but in this market also supply is aggravated by considerable sales during the winter and spring months of cockerels raised by domestic and egg producers who purchase mixed chickens.

Broiler production has reached a stage where it is essential to be efficient and the best producers are continuously seeking ways and means of reducing costs. In the Federation beef prices are lower than in most countries and therefore the broiler has to contend with a very strong price challenge and it is unlikely that broiler consumption will rise to the extent it has in countries where other meats are more highly priced.

The sale of cull hens also affects the price paid for broilers. The market for hens has been good and there is at present a demand for this class of bird weighing up to 4 lb. at 3s. 6d. lb. retail. The urban African is becoming an important consumer of this class of bird, which will assist in enabling egg producers to replace unprofitable stock at once.

Whilst most broiler producers process their own birds there are poultry processing firms in Salisbury, Hartley, and Bulawayo, as well as butchers operating in this field. Some producers have well equipped modern processing facilities but others leave much to be desired in this respect.

This matter of farm poultry dressing was taken up with the Health Department whose inspectors have inspected many farms this year. If conditions are not satisfactory it is intended that improvement will be forced under the Public Health Act where powers exist. Co-operation from farmers is expected which will secure improvement in quality and appearance of table poultry for sale.

Turkey production in the Federation has increased and quality improved, but limited imports for the Christmas trade are still required. With improved quality retailers and butchers are purchasing local stock more readily at reasonable prices. There is room for improvement in both quantity and quality to meet the demand, but in addition farmers must practise better methods of raising turkeys acceptable to the trade. Improved strains of turkeys for breeding are necessary to achieve satisfactory feed conversion and better carcasses.

There has been limited import of fowls into Northern Rhodesia from South Africa but appreciable quantities have moved from Southern Rhodesia to the Copperbelt, where, however, production is increasing and should shortly be able to satisfy requirements.

It should be noted that both eggs and table poultry are cheaper in the Federation than most countries except South Africa where feed costs are lower.

STOCK

Commercial poultry in the Federation consist of several well-known breeds but the vast majority of both layers and broilers are crosses between pure breeds, which on average give a superior bird.

The first cross most favoured and commercially tested for many years is the White Leghorn x Australorp which holds pride of place as the commercial egg producer. Next in popularity is probably the New Hampshire x Light Sussex, after which there are numerous crosses and also pure breeds used, particularly White Leghorn.

Amongst the broiler types the New Hampshire x Light Sussex is extensively used but also Hampshire x North Holland Blue and other cross cockerels for the *petit poussin* trade. During the year importations of highly improved stock from the United States of America and United Kingdom have been allowed. In consequence some excellent broiler types involving White Rock and White Cornish for broiler breeding and White Leghorn strains for egg production have been introduced. It is expected results from this stock will show up in a year or two, and when generally available distinctly improve the feed conversion and the quality of carcase above present day standards.

The modern trends in poultry breeding are not being ignored by local breeders, several of whom have paid visits to overseas countries to study methods during the year.

The introduction of some hybrid poultry strains was permitted under special conditions. Firstly, in one instance where the hybrid progeny for egg production were guaranteed for export only and, secondly, where breeding stock back to grandparent stock was imported to ensure that a breeding farm was being set up and not merely a multiplying establishment dependent upon regular overseas importations.

It was felt by this department and the R.N.F.U., who were consulted, that the open importation of hybrids would prejudice local breeders, risk introduction of disease, and require constant importations with only limited and problematical advantages to producers. The control of hybrid importations is therefore justified on these grounds.

Duck production increased slowly. The demand for ducklings for local and export purposes cannot be met by the few breeders engaged in the business.

FEEDS

Poultry rations consist of local grains, nut-cake, and imported fish-meal and lucerne meal, to a large extent. A considerable quantity of nut-cake, fish-meal and lucerne meal is imported. It should be possible to produce these requirements with the exception of fish-meal in the Federation.

Sources of supply of nut-cake have been erratic; as considerable quantities come from the Congo, delivery has been upset.

Yellow maize has not been available in Mashonaland this year but it is desirable that the Grain Marketing Board make it available for poultry rations when possible. Munga was also withdrawn from stock feeders owing to requirements for African consumption. This resulted in difficulties for manufacturers producing mixed poultry grains as no suitable substitute is available at the same cost.

The registration of poultry feeds under the Farm Feeds Act has been carried out and all rations checked by this Branch.

The supply of stock feeds under the seal of the Rhodesia and Nyasaland Standards Association became operative on the 1st September, 1960. Most manufacturers are members and the additional inspection and control will add to the confidence farmers have in these products.

IMPORTS AND EXPORTS

Imports. Imports of poultry products consisted mainly of dressed poultry to cover the shortfall on the Copperbelt during the first part of the year and for turkeys for the Christmas trade. The quantity dropped from 257,833 lb. in 1958/59 to 116,699 lb. in 1959/60, and the value from £38,000 to £18,000, indicating the increased local production this season. It should fall to negligible quantities next year. Other imports included small importations of breeding stock.

Exports. Exports consisted almost entirely of day old chickens to other African territories amounting to £26,000 in value, being a slight rise on the previous year. The main market was the Belgian Congo, and although consignments have still been going forward, there must inevitably be a considerable drop in this trade this season.

The following tables give details of the imports and exports for the Federation from August, 1959, to July, 1960, inclusive, and the number of poultry, poultry products, and value for 1959.

TABLE I — IMPORTS

Article and Country of Origin	Quantity	Value
Poultry, live:	No.	£
United Kingdom	4,374	1,428
Union of South Africa	3,356	441
Denmark	630	132
Ireland	500	675
United States of America	300	92
Netherlands	4	14
TOTAL	9,164	£2,682
Poultry, dressed:	lb.	
Union of South Africa	115,203	18,599
United Kingdom	856	103
Tanganyika	640	109
TOTAL	116,699	£18,811
Eggs, in shell:	dozen	
Union of South Africa	1,963	301
United Kingdom	13	47
TOTAL	1,976	£348
Eggs, liquid or dried:	lb.	
United Kingdom	99	68
France	72	18
TOTAL	171	£86

TABLE II — EXPORTS

Article and Country of Destination	Domestic Produce		Re-Exports	
	Quantity	Value	Quantity	Value
Poultry, live:	No.	£	No.	£
Belgian Congo	63,083	19,142	—	—
Kenya	30,025	4,038	—	—
Moçambique	17,907	2,479	750	97
Tanganyika	1,283	156	—	—
Uganda	800	131	—	—
Bechuanaland	254	33	—	—
United Kingdom	9	20	—	—
TOTAL	113,361	£25,999	750	£97
Poultry, dressed:	lb.		lb.	
Belgian Congo	1,102	209	—	—
Moçambique	259	61	—	—
Bechuanaland	52	2	—	—
TOTAL	1,413	£272	—	—
Eggs in shell:	dozen		dozen	
Moçambique	2,981	687	—	—
Bechuanaland	145	53	—	—
TOTAL	3,126	£740	—	—
Eggs, liquid or dried	lb. —	—	lb. —	—

TABLE III — NUMBERS OF POULTRY, POULTRY PRODUCTS, AND VALUE, IN 1959

		Southern Rhodesia	Northern Rhodesia
Fowls:			
Laying hens		300,600	111,300
Others		415,300	110,100
TOTAL		715,900	221,400
Ducks		30,200	6,000
Turkeys		24,000	5,400
Geese		6,100	1,100
Hen eggs sold	No. (doz.)	2,546,000	1,116,000
	Value	£445,900	£196,400
Table birds sold	Weight (lb.)	1,390,000	272,700
	Value	£230,600	£50,500
Day old chicks sold	No.	796,400	152,000
	Value	£73,600	£14,700

MATOPOS RESEARCH STATION

At this station the building programme was extended with the completion of a laying house, increased capacity for the Commercial Egg Laying Test, and foundations for an experimental house for broiler production which it is hoped to complete this year.

Experimental Work

Strains of New Hampshire Red and Light Sussex are being bred for improved meat type birds.

During the year local New Hampshire stock was compared with imported hybrid meat-type chickens ("Chunky Chicks"). The imported stock proved slightly but not significantly superior but numbers were insufficient to draw definite conclusions.

Feed trials of various types indicated that lowered salt feeding reduced water consumption resulting in drier droppings which assisted materially in fly control in caged birds.

Growth rate and food conversion were superior in cage reared broilers compared with floor reared birds.

Increased calorie value of the feed for growing stock retarded growth unless protein and vitamin content was also increased.

The results of the Matopos Commercial Egg Laying Test were published the March/April issue of the *Rhodesia Agricultural Journal*.

GWEBI COLLEGE

Poultry Branch

The Fortieth Annual Official Egg Laying Test concluded on January 30th, 1960. A full report was published in the March/April issue of the *Rhodesia Agricultural Journal*.

Results were given in two sections: A Standard Breeders' Test, where disqualifications for breed faults were applied, and a Commercial Breeders' Test, where these were ignored.

In addition a test on value of eggs produced less cost of feed consumed was run. The results were up to average in most respects with below average mortality and a decided improvement in cost per dozen eggs produced in the Light Breed Section.

The Forty-first Test commenced on March 1st, 1960, with all pens taken up.

Educational

A lecture programme of forty-two lectures on poultry husbandry was given to first year students, and practical instruction throughout the year by the Poultry Branch staff.

A short course for farmers was held from 8th to 12th August and attended by twenty-five farmers. I am of opinion that a two-year poultry managers course should be instituted at the College to supply the industry with locally trained managers and assistants for which there is a demand. The Diploma course is insufficient for this purpose and specialization is required. An intake of say two (men or women) annually for a specialist course of two years would fit those passing to undertake managerships which are at present filled by overseas applicants.

Stock and Experimental Work

A trial similar to that at Matopos was carried out with imported hybrid ("Chunky Chick") broiler stock with similar results as reported at Matopos. A private report was issued. Other work consisted of breeding the White Leghorn and New Hampshire flocks with a view to future crossing of in-bred stock for the production of hybrid layers suited to local conditions.

The additional laying houses of new design were completed and have been filled. Results from these "open" houses have been very satisfactory and they are undoubtedly well adapted to local climatic conditions.

The stock were subjected to the P.P.L.O. test for Chronic Respiratory Disease (C.R.D.) when it was found the young stock were all free but adult breeder stock badly infected. On the advice of the Veterinary Department these are all to be slaughtered and with precautions taken it is expected the whole flock will be P.P.L.O. free. This must be achieved as soon as possible.

The stock on hand as at 30th May, 1960, was as follows:

Adult birds	993
Growers under six months	1,647
Turkeys	71
Waterfowl	56
TOTAL	2,767

Total revenue from the Poultry Section: £4,170.

SPECIALIST EXTENSION AND ADVISORY SERVICES

The strong demand for advisory services of poultry officers in all three areas of Mashonaland, Matabeleland, and Northern Rhodesia continued and was carried out to the limit of the time and provision available. Particular attention was paid to advisory services in Northern Rhodesia where very regular and frequent visits to producers have been made by the poultry officer. The Chief Poultry Officer also made two special visits to Northern Rhodesia and the improvement in management on farms, particularly on the Copperbelt, is noticeable.

The poultry officer at Lusaka paid a visit of one week in August to Mashonaland where he interviewed progressive producers and attended the Salisbury Show.

Advisory services included over one thousand farm visits, half in Northern Rhodesia, farmers' meetings, National Poultry Committee meetings, Poultry Club meetings in Salisbury and Bulawayo, advice to stockfeed manufacturers, poultry processing and cold storage plants.

VETERINARY

The compulsory testing of all breeding stock for freedom from B.W.D. and fowl typhoid on farms from which stock is sold was carried out by the Field Veterinary Officials in Southern Rhodesia. In Northern Rhodesia also this service is provided though not compulsory.

Two outbreaks of typhoid caused considerable loss of income before the disease was cleared up by regular blood testing and slaughter. This disease is one of the most expensive and dangerous to poultry farmers, but fortunately is not prevalent where hygiene is good.

The incidence of other diseases showed no increase with the exception of Chronic Respiratory Disease, which is widespread. It is an insidious disease causing low mortality in most cases but lowering efficient egg production, growth rate and breeding capacity. An antigen test is available and some flocks have been cleared by means of a depopulation programme. This will, I am convinced, have to become a regular feature of the veterinary programme in maintaining a healthy flock in future. I would advise all breeders in particular to have their flocks tested and make provision for clearing the disease up if present, which need not be a costly procedure.

In Northern Rhodesia, Newcastle disease has caused some very severe losses on a few European farms and the disease appears to be widely distributed. All farmers in Northern Rhodesia would be wise to follow the inoculation instructions for immunization obtainable from veterinary officers or the poultry officer.

Dr. Coles, recently retired from Onderstepoort Laboratory, paid a week's visit to Southern Rhodesia at the instigation of a local firm of feed manufacturing and egg wholesalers. A poultry day including lectures and field demonstrations at Gwebi College was arranged at which Dr. Coles, the Chief Poultry Officer, Dr. Philip, and others gave lectures to about 150 farmers.

Dr. Coles subsequently visited Nyasaland. He warned of the danger of the introduction of American Newcastle and fowl malaria which he indicated existed on the East Coast. Subsequently it has been announced that American Newcastle disease has appeared on the Rand. I am in favour of prohibiting all importations from South Africa in consequence.

Owing to the prevalence of Newcastle disease in both the Northern territories and the complete lack of any control at the borders the risk of infection being carried to Southern Rhodesia is very great. The introduction of poultry into Southern Rhodesia from the north is prohibited but it would appear there is no way of enforcing regulations. This matter must be investigated with a view to better control.

SHOWS AND POULTRY CLUB WORK

During the year the Salisbury and District Poultry Club held a successful Young Bird Show in April and a major show at the Royal Agricultural Society's Show in August which were well supported. The Bulawayo Poultry Association, in view of the reorganization in that centre for the Trade Fair held in May, were not able to hold a show this year. However, this Association is sponsoring the Commercial Egg Laying Test being currently held at Matopos Research Station.

The Rhodesia Pedigree Poultry Breeders' Association continued its work and all members' farms and stock were inspected by veterinary and poultry officials of the Ministry. Emblems for chick boxes were used to advertise that quality stock was available and further progress towards the stock improvement ideals of the Association is being made. There are now some members in Matabeleland.

The Association staged an interesting exhibit at the Salisbury Agricultural Show.

Poultry officers officiated as judges at all the Agricultural Shows in Southern and Northern Rhodesia this year. A departmental exhibit and demonstration was organized at Kitwe Show.

STAFF

There have been no staff changes during the year. The full co-operation of all members of the Branch is acknowledged.

BRANCH OF BOTANY, PLANT PATHOLOGY AND SEED TESTING

Dr. G. R. BATES, *Chief Botanist and Plant Pathologist*

INTRODUCTION

The basic organization and administration of the Branch with its three sections concerned with botany, plant pathology and seed services remained unchanged. Although a full establishment of authorized staff was maintained it proved a difficult year for all sections due to secondments, overseas duty, leave and ill-health. Dr. G. R. Bates acted as Assistant Director of Research and Specialist Services for most of the period April to September, 1960; during his absence Dr. H. Wild took charge of the Branch. Mr. W. E. Kerr was awarded an F.A.O. Fellowship to study seed production and related subjects in the U.S.A. and Canada from March to August, 1960, inclusive. Mr. G. W. Herd, Plant Pathologist, also spent the period May to September, 1960, in Canada and the U.S.A. under an I.C.A. award for a study tour of wheat rust research centres.

These various dislocations placed a heavy strain on the remaining staff who were left with a heavier burden of administrative and advisory duties than usual.

An important development was the establishment of a regional plant pathology laboratory in Umtali to serve the needs of the Eastern Districts. The new laboratory is in the charge of Dr. J. O. Whiteside and was opened in July, 1960.

Welcome additions to the facilities of the Branch included a large extension to the Herbarium, new offices, storerooms and a laboratory for the Seed Testing Section and a plant growth chamber for wheat rust investigations. Further extensions to the seed testing laboratories have also been approved.

Demands upon all sections of the Branch for advisory and identification services were greater than ever before. Because of the temporary staff shortages already indicated several research projects had to be suspended and more attention given to advisory work. The Herbarium dealt with a record intake of new accessions despite which the staff also managed to maintain a satisfactory output of botanical publications. Noteworthy amongst these was the publication of the first part of Volume I of the *Flora Zambesiaca* in January, 1960. Another landmark was the appearance, in April, 1960, of a new botanical journal, *Kirkia*, edited by the Senior Botanist. Weed problems were high-lighted by the extraordinary rapid proliferation of the aquatic fern, *Salvinia auriculata* on Lake Kariba. A great deal of attention was given to this and other weed problems affecting dams and farming generally. Long-term investigations on poisonous and medicinal plants were continued.

For the second successive year, weather conditions did not favour the development of most summer crop diseases although certain virus diseases of maize and tobacco were quite widespread. Despite difficulties useful progress was made with our long-term studies on wheat, fruit and vegetable diseases.

The work of the Seed Services Testing Section again increased substantially and, despite the improved facilities and equipment available it was difficult to prevent occasional delays in supplying reports and advice. The pressure on this section is reflected by the general expansion in all branches of the seed industry during the period under review with the notable exception of grass seed where production dropped considerably due to adverse seasonal conditions.

Acknowledgement is given to the valued co-operation and assistance so freely provided by other Branches and Research Stations of this Ministry and particularly by the Department of Conservation and Extension.

The regular courses of lectures on plant pathology and seed testing were delivered by professional officers from the Branch to students at the Gwebi College of Agriculture. Talks and addresses were given to numerous meetings of Farmers' Associations and other organizations concerned with agriculture and horticulture. All sections of the Branch staged exhibits at the annual Salisbury Agricultural Show. The Plant Pathology Section again exhibited an instructional display and supplied an advisory service at the annual Horticultural Trade Show in Salisbury.

Two papers were published in the new botanical journal *Kirkia* during the period under review. In addition a paper on the classification of sorghums was presented to the Departmental Conference on Sorghums in June, 1960, whilst five cyclostyled pamphlets on seed production and four on deciduous fruit disease were prepared and distributed. Articles, notes and reviews were contributed to local farming journals and to the daily Press.

BOTANY

HERBARIUM

The total number of accessions for the year was 14,093, comprising 7,224 specimens received for naming and 6,869 named duplicates from other herbaria. The total number of specimens housed in the Federal Herbarium now exceeds 111,000, representing an increase of over 12 per cent. during the year. The number of specimens dealt with was 40 per cent. more than the previous highest figure attained in 1958-59. Five thousand five hundred and thirty-one plants were named for Federal and Territorial Governments and other public bodies. Named duplicates totalling 6,869 specimens were received from 16 herbaria in Africa, Europe and America.

Some 400 sheets collected by C. F. M. Swynnerton in 1905-7 were received from Kew. Five thousand two hundred and ninety-one duplicate specimens were distributed to 19 herbaria.

The following genera and families were sent on loan for study: *Amaryllidaceae* to Prof. Traub of La Jolla, California; *Buchnera, Sopubia* and *Becium* to Prof. Duvigneaud, Brussels; *Dipcadi, Camptorrhiza* and *Iphigenia* to Mrs. Mauve, Pretoria; *Euryops* to Dr. Norlindh at Lund.

Zornia material was returned annotated from Dr. Moehlenbrook of the University of Southern Illinois. Mr. Greatex, despite ill-health, continued his valuable work on orchids.

Collections were made by members of the Botany staff in the following areas: Melsetter (Phipps), South-west Bechuanaland (Dr. Wild), Northern Umvukwes (Drummond), Barotseland (Drummond), Lower Shire Valley (Phipps), Chiswiti Reserve (Phipps), Pungue-Buzi Estuary area, Moçambique (Dr. Wild).

The writing of the *Vitaceae* for the *Flora Zambesiaca* is well on its way to completion and six illustrations for this family have been completed by a local artist. Work on the writing of the *Simaroubaceae* has also been completed. Both these studies have been conducted by the staff of the Government Herbarium in Salisbury and will form part of Volume II of the Flora which is now well on the way to completion. Galley proofs of all families contained in Volume I, Part 2, have been corrected and returned to London and it is expected that this part will be published about the end of 1960.

Considerable attention was given to the study of the *Gramineae*. As with other plants the number of accessions has been very large. One of the major tasks during the year has been the naming of the grasses in the herbaria at Zomba (Department of Agriculture, Nyasaland); Mt. Makulu (Department of Agriculture, Northern Rhodesia); Abercorn (International Red Locust Control Service), and the Gwebi Agricultural College. All this material was sent to us on loan. Material has also been named for the C.I.C.A., Lourenço Marques and the Division de Botanique, INEAC, Yangambi. The most important collections of grasses received for our own herbarium include those from Mr. Vesey-FitzGerald (Abercorn, Northern Rhodesia); Mr. Fanshawe (Copperbelt and Livingstone areas); Mr. Robinson (Copperbelt and Kasama, Northern Rhodesia); Mr. Drummond (Barotseland); Mr. Soane (Chipinga); Mr. Vaughan-Evans (Nyamandhlovu), and Mr. Goodier (South-eastern Lowveld).

Our material of *Eragrostis* and related genera has been loaned to the British Museum for *Flora Zambesiaca* studies. We have begun to accumulate material of the *Arundinelleae* from various herbaria as it is intended that this group shall be written up in the Salisbury herbarium for the *Flora Zambesiaca*. A botanical grassland survey of the Wiltshire Estates, near Enkledoorn was carried out by the Grass Botanist who also prepared a paper on sorghum classification for presentation to a specialist meeting on sorghum convened by the Agriculture Department in June, 1960.

During the year authority was given by the Secretary of Agriculture and the Controller of Printing and Stationary to begin publication of an official botanical journal of the Federal Herbarium. *Kirkia*, as the new journal has been named, aims to publish articles on taxonomy and general botany concerning Africa. Priority is naturally given to articles dealing with the Federation. The first part of *Kirkia* appeared in April, 1960, and has been well received in international botanical circles. Exchange arrangements have been entered into with numerous botanical institutions who have already begun to send their publications in exchange for *Kirkia*. This has resulted in our receiving a considerably increased number of important botanical journals for our library. In this first year of publication articles have already been received from the following: A. W. Exell,

British Museum; E. A. Robinson, Kasama; J. D. Chapman, Dedza; B. L. Mitchell, Game Department, Northern Rhodesia; Prof. A. Fernandes, Lisbon; V. S. Summerhayes, Kew; P. J. de Wolf, Kew; J. P. L. Brenan, Kew; B. Verdcourt, Nairobi; D. B. Fanshawe, Kitwe; R. Goodier and J. B. Phipps, Salisbury.

Botanic Gardens

Owing to the transfer during the year of the Gardens Superintendent to a new assignment for the study of groundnut problems little development of the gardens was possible. However, by making use of the part-time services of the Field Assistant responsible for weed control duties the gardens have been maintained in a reasonably orderly condition. The Federal Herbarium and National Botanic Gardens Fund, which is a privately sponsored body, was successful in raising nearly £17,500. This magnificent response, although it falls short of the set target, should enable an early start to be made in developing the gardens on sound botanical lines in the near future.

Economic Botany

The growth in importance of weed problems in the Federation has been so great during the past year that it has become more and more evident that a reconsideration of the whole subject is urgently necessary. At present the administration of the Noxious Weed Act and the responsibility for weed advisory work remains nominally under the control of this Branch but in the case, for instance, of the enormous *salvinia* infestation on Lake Kariba which has developed in the last year or two, it was soon realized that this problem alone was quite beyond the competence of our small establishment of botanists to deal with satisfactorily. The organization of research projects concerned with *Salvinia* on Lake Kariba is now handled by the Kariba Lake Co-ordinating Committee which forms part of the Ministry of Economic Affairs. Under the direction of the latter Ministry a *Salvinia* sub-committee has been formed on which this Branch is represented by the Senior Botanist. A herbicides expert has recently been engaged by the committee to conduct experiments at Kariba whilst negotiations are in train for an international team of specialists to investigate various problems at Kariba under the auspices of F.A.O.

Discussions took place during the year under review with the object of devising a more effective and practical procedure for administering the Noxious Weeds Act, particularly in regard to the organization of a comprehensive inspection service. The Act itself being more than 34 years old also requires redrafting in the light of recent agricultural developments.

Stress has previously been laid on the need for the appointment of specialist weed officers to tackle the many problems in this field. It is increasingly evident that if we are to make full use of the ever expanding range of chemical herbicides and arboricides such officers will have to be recruited.

An important contribution by the Botany Section on weed matters during the year has been the preparation of a handbook on *Harmful Aquatic Weeds in Africa* by Dr. H. Wild at the request of CCTA/CSA. The text, which is now completed, describes about 60 African aquatic plants and will be fully illustrated.

A note on regions in the Federation ecologically suitable for the growth of water hyacinth was prepared for the Scientific Secretariat of CCTA/CSA: In addition a chapter on chemical weed control was contributed towards a joint article on the maintenance of weed-free farm dams and irrigation channels for publication in the *Rhodesia Agricultural Journal.*

Organizational changes in the campaign against water hyacinth followed new arrangements with the Department of National Parks whereby the latter undertook the practical control of this aquatic pest throughout the upper reaches of Lake McIlwaine and also the Makabusi River. These arrangements have enabled the Field Assistant and his small gang of noxious weed scouts to be transferred to other weed control duties, partcularly against the serious water hyacinth and *Salvinia* infestations in the Sinoia, Odzi and Tsungwesi districts where potentially dangerous situations have arisen.

Work on poisonous plants was continued in co-operation with the Department of Veterinary Services. The following plants have been proved to be toxic to animals:

Chironia transvaalensis, Cestrum aurantiacum, Combretum platypetalum, Datura tatula, Dichapetalum cymosum, Gnidia kraussiana, Melia azedarach, Nicotiana tabacum, Ranunculus Multifidus, Sarcostemma *viminale, Senecio sceleratus, Solanum incanum, Solanum panduriforme, Urginea burkei, Urginea altissima, Vernonia ampla, Phytolacca dodecandra, Bersama swynnertonii.*

It is hoped to published a detailed illustrated account of the results of this research within the next few months in the *Rhodesia Agricultural Journal.*

A local firm has contracted with an important U.S.A. pharmaceutical manufacturer to make a random survey of some 2,000 indigenous plants for alkaloids. The Botany Section is collaborating in this work by assisting in the naming and collecting of the plants. To date, about 300 have been collected and named, 200 of these have been analysed of which 10 per cent. contain alkaloids.

Dr. H. Wild and Mr. J. M. Rattray, of the Matopos Research Station, have collaborated in the production of a vegetation map of the Federation which will form part of the atlas at present being prepared by the Surveyor General's Office. This map has now reached the first proof stage.

PUBLICATIONS

1. "Sir John Kirk" by H. Wild. *Kirkia* Vol. I, Part 1, April, 1960.
2. "Vitaceae" by H. Wild and R. B. Drummond, *Kirkia* Vol. I, Part 1, April, 1960.
3. *Flora Zambesiaca,* Vol. I, Part 1, edited by A. W. Exell and H. Wild, Crown Agents for Overseas Governments and Administrations, London (published 28th January, 1960).

PLANT PATHOLOGY

ADVISORY

Considerably more field work and advisory visits to farms were possible as a result of a more generous allocation of travelling funds. Most areas of the country were visited and, as in previous years, special efforts were made to provide a regular advisory service for the Eastern Districts. The establishment of a regional plant pathology laboratory at Umtali in July, 1960, under the direction of a Senior Plant Pathologist enabled even closer attention to be paid to the Eastern region and its phytopathological problems.

For the second year in succession climatic conditions were unfavourable for the development of most summer crop diseases and, with a few exceptions, no serious outbreaks were recorded. The number of specimens submitted to the Salisbury and Umtali laboratories totalled 599 and embraced 20 new host or disease records, the following being of particular interest and importance:—

Bacterial canker of tomato due to *Corynebacterium michiganense* (Smith)— map Jensen; foot rot of sesame due to *Phytophthora dreschleri* Tucker; leaf spot of broad bean (*Vicia faba* Linn.) due to *Stemphyllium botryosum* Wallr., and rust of edible pea due to *Uromyces fabae* (Pers.) de Bary. Root rot due to the fungus *Armillaria mellea* (Fr.) Quel. was observed for the first time attacking banana, cultivated roses and a species of *Albizzia.*

Tobacco. Seed-bed diseases were relatively unimportant which reflects the general improvement in management techniques together with the adoption of earlier planting. Anthracnose (*Colletotrichum tabacum*) was not reported until November, 1959, when it appeared amongst both Virginia and Turkish seedlings. In the field also the crop was fairly free from serious diseases. Numerous reports of "wildfire" followed a rainy spell in December but dry weather in January checked its further spread. Several instances of the physiological disturbance "red rust" were recorded. Rosette and the closely allied distorting virus disease now known as "bushy top" were again prevalent. White mould was troublesome in some districts.

Potato. Late blight was again of minor consequence amongst summer crop plantings despite a swing to the use of the susceptible "Up-to-Date" variety. On the other hand, early blight (*Alternaria solani*) became more noticeable and was responsible for considerable defoliation, certain newly introduced varieties possessing field resistance to late blight proving very susceptible to early blight. Bacterial wilt was recorded on several occasions, mainly from the Eastern Districts. Seasonal conditions favoured the spread of aphid borne virus diseases and some crops developed heavy infections of virus Y. Mildew, common scab and black-leg were occasionally observed.

Maize. The period under review showed a remarkable contrast to the previous year in that there was very little evidence of cob and stalk rots associated with *Diplodia zeae* and *Fusarium graminearum.* Maize streak virus, however, continued to increase and was of general occurrence amongst early planted crops grown with irrigation for fodder and "green mealie" purposes. Many virus infected plants were also detected growing as volunteers in winter irrigated lands. The widespread incidence of streak virus on out of season crops throughout the principal maize growing districts of Southern Rhodesia is viewed with concern although, so far, the disease has not been generally serious in the main summer plantings. The reason for the comparative absence of virus infection in the summer crop is not fully understood but may be related to the behaviour of the insect vector.

Helminthosporium leaf blight was of minor consequence throughout the 1959/60 crop whilst, for the third successive year no tropical rust (*Puccinia polysora*) was observed or reported. Localized outbreaks of a bacterial stalk rot and head smut (*Sorosporium reilianum*) occurred in the Salisbury district.

Sugar-cane. Surveys of large-scale plantings at Triangle and Chirundu showed that sugar-cane smut continues to be prevalent in stands of moderately susceptible varieties. Gumming disease (*Xanthomonas vasculorum*) was again recorded on the N.Co. 310 variety. Mosaic virus was found on recently introduced plants of the BA 10/12 variety. N.Co. 376 canes were attacked by ring spot (*Leptosphaeria sacchari*).

Forage and Green Manure Crops. The unusually low rainfall was probably linked with the relative freedom from diseases of these legumes in 1959/60. A few cases of root and vine rot (*Phytophthora dreschleri*) of velvet bean were reported from Mashonaland. Clear-cut evidence for the seed-borne nature of this disease was obtained, the pathogen developing from a commercial seed sample during routine germination tests. Ashy stem blight caused by the fungus *Macrophomina phaseoli* was recorded for the first time from velvet bean. No stem-break disease in sunnhemp crops was reported and fewer instances than usual of lucerne leaf spot and rust diseases.

Vegetables. Ascochyta blight (*Mycosphaerella pinodes*) was more prevalent than usual on winter irrigated peas grown for canning and dehydration. Other diseases of this important crop were less in evidence than in previous years, the incidence of powdery mildew being low whilst downy mildew (*Peronospora viciae*) was only observed on peas grown at over 3,000 feet.

French beans of the variety Double Dutch Princess were destroyed by rust in lowveld plantings, nearby plantings of Canadian Wonder being only slightly attacked. Scab (*Elsinoe phaseoli* f. sp. *vulgare*) was noted on the French bean variety Seminole. Ashy stem blight also caused losses to French bean crops at Odzi. Elsewhere seed crops were occasionally attacked by anthracnose and halo blight.

The most important new disease recorded during the period under review was the discovery of bacterial canker of tomato (*Corynebacterium michiganense*). Five commercial crops, both outdoor and glasshouse, were attacked, all in the Salisbury area. The disease is thought to have been introduced by infected seed. Because of the localized nature of these outbreaks strenuous efforts were taken to eradicate the disease. Late blight was less destructive on tomatoes than in previous years and few serious outbreaks were reported. Septoria leaf spot, however, was much more severe than usual since the dithiocarbamate fungicides "zineb" and "maneb" now generally used to control late blight appear ineffective against *Septoria lycopersici.* Leaf mould (*Cladosporium fulvum*) was again recorded on summer crop tomatoes grown in the open in the Salisbury area. White rot of onion (*Sclerotium cepivorum*) was identified on this host for the first time since 1943. Septoria leaf spot caused losses amongst field crops of lettuce planted in February and March.

Coffee. Coffee plantings have been established in many parts of the Eastern Districts in recent years. In several of these a yellowing of the young leaves developed during the spring. The disorder is possibly the same as the so-called "hot and cold disease" recorded from East Africa where it is associated with unfavourable growing conditions during the winter period.

Die-back of coffee bushes at Chipinga was due to *Fusarium lateritium* var. *longum.*

Deciduous Fruit. The incidence of bitter rot was substantially less than in previous years. This is attributed to the low seasonal rainfall and more particularly the exceptionally dry January. Powdery mildew was commonly found on apples and peaches. A die-back of neglected apple trees was associated with *Diaporthe perniciosa.*

Citrus. Stem-pitting of grapefruit due to tristeza virus was found to be widely distributed. The same virus was identified from Valencia orange trees using West Indian lime seedlings as indicators. A die-back of Premier orange trees followed frost injury and subsequent sun-scald of the exposed trunk and branches.

Flowers. A fresh outbreak of kromnek (*Lycopersicum* virus 3) was discovered in a Bulawayo suburb where dahlias, zinnias and nasturtiums were found to be infected in several gardens. Three kromnek infected dahlias were also detected in Salisbury during routine inspections made in terms of the Kromnek Regulations.

Gladiolus rust was prevalent whilst *Cercospora* leaf spot was recorded for only the second time on this host. *Fusarium* wilt was again the most troublesome disease of carnations.

Specimens of the mildew fungus (*Oidium* sp.) from dahlia and pumpkin were parasitized by a species of *Cicinnobolus.*

Research

Heavy demands for the services of Plant Pathologists on advisory matters together with the dislocation caused by duty leave overseas, illness, and secondments all conspired to interfere with the various research projects of the section.

Maize. The survey of the incidence and distribution of maize streak virus was continued and further evidence obtained regarding the almost general distribution of the disease throughout the principal maize growing districts of Southern and Northern Rhodesia. The heaviest infection occurred in irrigated crops during the spring months although a severe outbreak developed for the second successive season in an experimental summer crop planting at the Henderson Research Station.

Wheat. Numerous specimens of wheat stem rust *(Puccinia graminis tritici)* were identified. Most of the races keyed out to 21 but two sub-races within this race were also recognized based on differences in the type of pustule produced on the variety Gabo. Race 34 which was widespread two years ago, was found in less than one per cent. of the current collections. Assessments of both leaf and stem rust were made on the International Rust Nursery planted for the first time in Southern Rhodesia. Several promising sources of resistance were noted from which the wheat breeder made numerous selections. This Rust Nursery will form a regular part of the wheat breeding programme in the future.

Potato. All foundation stocks of potato varieties maintained by the Department in the Eastern Districts were tested serologically for freedom from virus X. Comparative tests were also made using the local lesion host *Gomphrena globosa* for detecting virus X. This latter technique is more sensitive and efficient and will probably be adopted instead of the serological method.

Legumes. In continued field tests an indigenous strain of buffalo bean (*Mucuna pruriens*) remained free from root and vine rot caused by *Phytophthora dreschleri,* whereas standard velvet bean varieties developed 36 per cent. infection. Seed was obtained from crosses between the indigenous and commercial types but the hybrid progeny, which shows certain undesirable agronomic characteristics, has yet to be tested against the disease in the field.

Deciduous Fruit. Spray trials for controlling bitter-rot of apples were again conducted in commercial orchards situated in high rainfall areas. The superiority of the maneb-Bordeaux mixture schedule previously reported was confirmed. Maneb alone was markedly more effective than zineb alone but slightly inferior to the maneb-Bordeaux mixture schedule in these trials.

SEED TESTING

The appointment of a clerk enabled the technical staff to devote their full attention to laboratory duties and thereby to achieve some reduction in the persistent back-log of samples awaiting test. Throughout the year both seed inspectors and laboratory technicians were hard pressed to cope with the pressure of work and the insistent demands of farmers interested in the prospects of this new industry. More than 400 visitors called at the laboratory for information and advice on seed production matters.

Extraneous duties, including those associated with the F.A.O. World Seed Year programme and our participation for the first time in referee tests on grass and various grain seed samples on behalf of the International Seed Testing Association, also took up an appreciable amount of time.

The absence of the Officer-in-Charge for more than six months in the U.S.A., Canada and Europe during his tenure of an F.A.O. fellowship threw an extra burden on the remaining professional staff.

LABORATORY

Samples of seed received totalled 1,278, representing a small reduction compared with the previous year. Despite the decline in the number of samples handled the number of germination tests conducted rose sharply from 2,091 in 1958/59 to 3,359. This increase is explained by an expansion of the experimental work to determine the most suitable techniques for testing local seeds and also the heavier volume of retesting necessary. Of the total samples 89 were rejected by failing to satisfy the prescribed minimum standards and another 20 samples were rejected as they fell short of the various Seed Association requirements. Numerous special tests for disease, identification and the presence of dodder were made. A total of 149 phytosanitary certificates were issued for export consignments as well as 22 international seed-testing certificates. Charges for seed-testing were reviewed and a new scale introduced on the 1st March, 1960.

Seed-borne pathogens of both certified hybrid and open-pollinated maize were less in evidence than in recent years. Seasonal conditions may accout for this since the grain size of the 1959/60 seed maize crop was considerably below the average. Preliminary tests showed that the vigour and germination of the smaller grain was not impaired. Another pleasing feature of the 1959/60 seed maize crop was the low incidence of *Colletotrichum graminicola* amongst hybrids and the complete absence of *Diplodia macrospora* in the samples examined.

SEED PRODUCTION

With the exception of some Northern Rhodesia crops all field inspections of pasture grass, tobacco, vegetable and flower seed, and potato crops registered under the certification schemes of the four Associations concerned were conducted by officers of this Branch. The phenomenal rate of expansion which characterized the earlier years of the local industry has now settled down to a more reasonable level. This, coupled with a more adequate provision for travelling, has enabled the seed inspectors to cope more satisfactorily with the needs of growers.

1. *Grasses.* Growers experienced an unusually difficult season and the production of certified seed fell by nearly 50 per cent. to 56,000 lb. The final figures for the several varieties grown were not available at the time of writing this report. Katambora Rhodes remains the most popular grass but production of Giant Rhodes is steadily increasing. *Helminthosporium carbonum* again attacked crops of both Rhodes grasses and was particularly damaging to the Katambora variety. Another species of *Helminthosporium* was discovered on the Ermelo strain of Weeping Love Grass causing serious damage to the seed.

2. *Vegetable and Flower Seed.* The 2,150 acres planted for vegetable seed production represented a very substantial increase over the previous year. Of this total, 1,276 acres consisted of peas and 817 acres of beans. Smaller acreages of lettuce, radish, cauliflower and various flower seed crops were also planted. The season's production of certified vegetable seed is expected to reach nearly two million pounds weight compared with 750,000 lb. in 1958/59.

Peas seed yields were disappointing and there are signs that contracting merchants are losing interest in this crop and swinging over to bean seed instead. Prospects for lettuce seed are more promising especially if it is derived from crops free from mosaic virus.

Late rains and, in some cases, the use of overhead irrigation led to undesirable outbreaks of disease in pea and bean seed crops. *Alternaria raphani* and *A. brassicciola* occurred on locally produced radish seed.

The Rhodesia Vegetable and Flower Seed Growers' Association altered its name to the Rhodesia Horticultural Crop Seeds Association and intends to expand its activities to include many crop seeds not hitherto controlled by existing seed associations.

3. *Potatoes.* One thousand and eleven acres were registered for certification of which 108 acres were rejected largely due to diseases and pests. Another 19 acres were downgraded. Eighty-five per cent. of certified potatoes consisted of Up-to-Date, Walanga and Pimpernel, the first-named variety being outstandingly the most popular. The overall production of certified seed was greater than in the previous season.

4. *Tobacco.* Production of certified seed at 5,200 lb. was more than three times the amount produced the previous year. Some 950 lb. of the present crop consisted of the Turkish variety Soulouk. Four crops were rejected owing to the presence of diseases and poor stands. More than 85 per cent. of tobacco growers in Northern and Southern Rhodesia used certified seed for their 1960-61 crop. It was possible to establish a reserve of seed to ensure continuity of supply of certified seed.

In the course of the year an approval scheme for seed wheat was introduced and 13 acres of the three most promising varieties were grown by three farmers. Consideration was also given to new approval schemes for groundnuts and sorghums but their introduction depends upon overcoming certain technical difficulties in respect of the range of varieties which might be included.

INVESTIGATIONS

Further tests on Virginia type tobacco seed treated with 0.25 per cent. silver nitrate instead of the usual 0.1 per cent. solution showed that its vigour and germinating ability was not affected when tested two years after treatment.

The original stubble mulch trial with maize at the Gatooma Research Station was discontinued after four years and replaced by two new trials designed to examine the effects of fertility, cultural operations and rotations upon the onset of cob and stalk rots. No clear-cut results were obtained from the first season of these new trials apart from the expected reduction in the amount of cob-rotting with increased levels of nitrogen.

A more intensive research programme on seed production problems of horticulural crops was planned by the Departmental Seeds Research Advisory Committee at the Henderson Research Station for the 1960 season. Experimental plantings of peas were also made at the Grasslands Research Station. Detailed results are not yet to hand but at Grasslands the application of nitrogen increased yields although *Rhizobium* inoculations were aparrently ineffective.

GENERAL

The Branch was represented on many departmental and other committees including the technical committees attached to each of the four Seed Growers' Associations. More than 100 local meetings were attended by members of the staff during 1960.

The Chief Botanist and Plant Pathologist was a member of the Federal delegation to the 15th Session of the Commission for Technical Co-operation in Africa (C.C.T.A.) held at Tananarive, Madagascar, during February/March, 1960. He continued his membership of the Scientific Council for Africa (C.S.A.) attending its eleventh annual meeting in Cape Town during September, 1960. Amongst other activities he undertook on behalf of C.S.A. was the chairmanship of a Specialist Meeting on Open Forests which took place at Ndola, Northern Rhodesia from 17th to 23rd November, 1959. Dr. Bates also represented the Ministry at another C.S.A. Specialist Meeting on Water Treatment in Pretoria during the latter part of September, 1960. As the Federal Liaison Officer for the Commonwealth Agricultural Bureaux he was more heavily committed than usual by the preparation of the brief for the Federation's delegation to the 1960 C.A.B. Review Conference.

Dr. H. Wild also attended the C.S.A. Specialist Meeting on Open Forests at Ndola as a representative of this Ministry. Later he visited Portugal in September, 1960, to attend the biennial meeting of A.E.T.F.A.T. and also a meeting of the editorial board of the *Flora Zambesiaca* project.

CHEMISTRY BRANCH

DR. H. WEINMANN, *Chief Agricultural Chemist*

Steady progress has been maintained during the year. The staff position remained fairly stable and there were no major changes. Mrs. M. C. Nievergelt, a Technical Assistant, resigned after nearly eight years of service, and her place was taken by Miss S. A. Goddard-Jones. The death, due to illness, occurred of Mr. Chinere Bobo, senior laboratory hand, who had served the Branch loyally for 18½ years and whose passing is a very definite loss to the Branch.

A new Technical Assistant's post was created for secondment to the Matopos Research Station, as a result of which Mr. J. Moerman was taken on the staff, while Mr. A. Giessler will be transferred to Matopos as soon as the laboratory there is equipped. Mr. H. R. R. Meterlerkamp was transferred on secondment to the Sabi Valley Experiment Station to replace the soil physicist, Mr. B. D. Soane, who will be stationed in Salisbury from November, 1960, onwards. Two professional officers have tendered their resignations to join a local research organization but were still on the staff at the close of the year. Mr. D. P. Thornhill was granted a two-year Commonwealth Scholarship which will be taken up in January, 1961.

The number of samples analysed and reported upon is given below but it will be realized that such data give only an incomplete record of the Branch's activities, more particularly as no such figures can be given for the Research and Soil Survey Sections.

Number of Samples Analysed in 1959/60:

General Section		4,012
Soil Testing Section—		
Advisory	3,631	
Investigatory	759	
		4,390
TOTAL		8,402

Though somewhat lower than last year's figure (9,169) the total of 8,402 samples represents a considerable output. The shortfall of 767 samples is largely due to a smaller number of routine soil samples submitted by farmers, though this is partly counterbalanced by a larger number of various samples analysed for the research stations. No figure is given for the Research Section (pasture research and animal nutrition samples) as in previous years. As a result of internal reorganization such samples, at least as far as they are of a routine nature, are now analysed by the General Section and their number is included under that heading. Detailed accounts of the activities of the individual sections are given below but a number of features deserve special mention.

The total number of samples analysed by the General Section (including routine samples previously handled by the Research Section) shows an increase of 509 samples over last year's figure for the combined output of the General and Research Sections. Of the total of 4,012 samples, 3,175 were analysed for other Government Departments and Research Stations, including 1,473 samples of feeds and faeces from feeding trials, 838 various plant samples and 122 leachate samples. Other items of interest are 364 blood samples analysed for inorganic phosphorus in connection with aphosphoresis investigations, and 657 toxicological specimens tested for the Veterinary Department.

Some of the above figures are an indication of the increasing demands for analytical work as a result of more intensified research work at the various stations. It is largely due to these increased demands that the professional officers of the General Section have not been able to spend more time on other important matters such as the analysis of official samples of fertilizers and farm feeds under the Act. It is for this reason that only 63 official samples (fertilizers, farm feeds and cattle dips) could be analysed. It is hoped that the position will be materially improved once laboratories have been established at all the major Research Stations and staffed by seconded Technical Assistants who will be able to do the major part of the routine analytical work under the supervision of this Branch.

The Soil Testing Section has again successfully supplied a much needed and appreciated service to the farming community. Though the number of soil samples submitted by farmers for advisory purposes (3,655) showed a drop of 20 per cent. as compared with last year's figure, it was still 13 per cent. higher than that for 1957/58. On the other hand, the number of soil samples received in connection with research projects, trials and field experiments (912) exceeded last year's number by 44 per cent. About 70 per cent. of the advisory work concerned fertilizer recommendations for tobacco and maize. While in previous years about twice as many reports were required for maize, the number of maize reports is now equal to the number of reports for tobacco, indicating a relatively increased interest on the part of food farmers. Over the past few years there has also been an appreciable increase in the number of soils analysed for Northern Rhodesian farmers, and the number of soil samples analysed for Northern Rhodesia was equal to that for Southern Rhodesia if calculated per unit area of land under cultivation in the two territories.

The activities of the Soil Survey Section have derived benefit from the fact that the section has now a fully trained staff. While in previous years usually one or two major soil surveys were undertaken during the field season, in 1959/60, 20 smaller field investigations were carried out. A considerable proportion of these was in the higher rainfall areas, mainly in the Eastern Districts, and included amongst others the following: Several minor Native Department irrigation projects in the south of the Colony, experimental areas in the Stapleford and Erin Forest Reserves, the Melsetter Pasture Research Station, and tea-growing areas in Southern Rhodesia and Nyasaland. In addition, a considerable amount of laboratory work has been completed, including the full analysis of 286 soil samples, most of them from surveys of the past two field seasons, and work on methods of determining water infiltration rate and hydraulic conductivity in soils.

A considerable amount of useful work has again been done by the Research Section. Work has been continued on the investigation of the biological activity and the organic matter status of soils, and the effect of soil drying on the breakdown and availability of soil nitrogen. Good results have been obtained in studies on determining available soil phosphorus by the use of anion exchange resins and consideration is given to using this method for routine purposes. The minor element survey based on plant samples collected in 1953 and 1958 has been completed and has yielded valuable information particularly regarding the copper, zinc and molybdenum status of local soils and crops. However, much further work is required and adequate greenhouse facilities are essential to supplement the analytical work by plant studies under controlled conditions. The investigations on sandveld infertility have been continued, and have confirmed that acidity and a low content of exchangeable bases are the main factors causing lack of growth in sandveld soils, but other factors, such as multiple nutrient deficiencies and unfavourable soil physical conditions, often appear to play a role.

A limited amount of soil physical work has been carried out, but with the transfer of the Senior Soil Physicist to Salisbury early in the coming year this important aspect will receive much more attention in the future.

Good progress has been made in the development of improved spectrographic techniques, and while a considerable number of plant samples have been analysed for advisory purposes in cases of suspected minor element deficiencies, it is realized that it is impossible to develop this work into a general routine service under present circumstances.

The Chief Agricultural Chemist and the Senior Officers of the Branch have spent a considerable amount of time on the drafting of new regulations governing the registration, sale and official control of agricultural liming materials. The draft of these regulations has been circulated to all interested parties for comment, and it is hoped that it will be possible to publish these regulations in the near future. An amendment to the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952, particularly required in connection with the new regulations was passed by the Federal Parliament during the year.

Co-operation with the Standards Association of Rhodesia and Nyasaland has continued. The Chief Agricultural Chemist served on the Animal Feeding Stuff Committee and acted as chairman of a sub-committee charged with the drafting of suitable analytical methods for animal feeding stuffs. As a result of the efforts of these committees standards for cattle, pig and poultry feeds, as well as standard chemical methods for these feeds, have been published during the past year by the Association, and a certification marking scheme has come into operation. A significant improvement in the quality of farm feeds available to farmers in the Federation may be expected from this development.

As in previous years the Chief Agricultural Chemist and the Senior Officers of the Branch served again on a number of committees, such as the Southern Rhodesia Research Advisory Committee, the Fertilizer Advisory Committee, the Hydrology Co-ordinating Committee, the Kafue Pilot Polder Advisory Committee, the Rhodesian Agricultural Journal Editorial Advisory Committee, the Drainage Advisory Committee, and others. Lectures were given to farm-planning and irrigation courses of the Department of Conservation and Extension, to students of the University and of Gwebi Agricultural College, and to farmers' and plot-holders associations.

Dr. D. H. Saunder attended the Third Inter-African Soils Conference at Dalaba, Guinea, where he presented three papers on behalf of the Branch and also acted at rapporteur for the section dealing with maintenance of soil fertility. Mr. D. G. Bushnell left towards the end of the year on a four-months I.C.A. tour to study biochemical methods and fertilizer and feedstuff control in the U.S.A., where he also attended the Seventh International Congress of Soil Science at Madison, Wisconsin.

Mr. R. G. Thomas and Mr. J. G. Thompson accompanied Mr. T. R. Paton, Assistant Director of S.P.I. on a pedological tour in Southern and Northern Rhodesia, to study the classification of the soils of the Federation for the projected soils map of Africa.

The majority of the professional and technical officers of the Branch attended the First Federal Science Congress held at Salisbury in May, 1960, and two scientific papers were presented, one by Dr. H. Weinmann and one by Mr. J. G. Thompson.

As in previous years, the Branch has maintained close and friendly co-operation with the Research Stations, and other Government departments and institutions, both within and outside the Federation.

Thanks are due to all members of the staff for their loyal co-operation throughout the year.

A detailed account of the activities of the individual sections follows:

GENERAL SECTION

In spite of certain disruptions caused by the absence on long leave of one member of the staff, by a resignation and, finally, by the departure of the Senior Officer to the U.S.A. on an I.C.A. study tour, a considerable amount of work has been accomplished.

The total number of samples analysed amounted to 4,012. This figure includes routine samples from the various Research Stations, which in previous years were analysed by the Research Section, and if compared with the combined output of the General and Research Sections for 1958/59, represents an increase of 509 samples. Of the total number (4,012) of samples, 3,175 or nearly 80 per cent. were analysed for various Government Departments, particularly Research Stations.

Apart from anlaytical work, 34 Winchester quarts of standardized sodium hydroxide solution were prepared for the Dairy Branch, and 143 Winchester quarts of standardized iodine dip testing solution for the Veterinary Department.

The collection of monthly radio-active fall-out samples for the U.S. Atomic Energy Commission has been continued.

Table I shows the breakdown of samples analysed during the past year.

Samples analysed under the Provisions of the Fertilizers, Farm Feeds, Seeds and Remedies Act, 1952. During the year 1959/60, 28 fertilizers, 32 farm feeds and three cattle dips were sampled and analysed under the provisions of the Act. These figures are slightly lower than last year's (26 fertilizers, 45 farm feeds and eight cattle dips).

TABLE I

SAMPLES ANALYSED IN THE GENERAL SECTION

Fertilizers, Manures and Limes:	
Fertilizers	26
Fertilizers (official samples)	28

Composts and kraal manures	12
Miscellaneous manures, etc.	10
Limes and limestones	21
Farm Feeds and Vegetable Products:	
Farm feeds	72
Farm feeds (official samples)	32
Cereals	343
Legumes	220
Tobacco	4
Grasses and silages	141
Other vegetable products	296
Animal Products:	
Blood samples	364
Miscellaneous animal products	35
Feeds and Faeces from Feeding Trials	1,473
Oils and Fats	1
Essential Oils	3
Waters	207
Toxicological Specimens:	
Analyses for arsenic — positive	352
Analyses for arsenic — negative	262
Other poisons	43
Protection Products:	
Arsenical dips	50
Organic dips	21
Miscellaneous:	11
Total	4,012

Of the 32 official farm feeds samples analysed, 12 were cotton-seed cakes imported from Portuguese East Africa and sampled by the B.S.A.P. in Bulawayo and Fort Victoria. Analysis showed these materials to be rather variable in composition.

Fertilizers, Manures and Limes (other than official samples). The volume of work of this nature decreased from a total of 117 in 1958/59 to 69 during the past year. The drop is mainly due to a decline in the number of agricultural lime analyses, in which a considerable interest was shown during the previous year.

Farm Feeds and Vegetable Products (other than official samples). The total number of samples reported under this heading amounted to 1,076 and included a large number of samples from the various Research Stations. The principal components were 294 wheat samples from the Sabi Valley Experimental Station, 210 lucerne and 94 grass samples from the Matopos Research Station and 240 miscellaneous plant samples from the Henderson and Grasslands Research Stations.

Animal Products. The number of samples of this type (399) shows a considerable decrease if compared with last year's figure of 794. This is essentially due to the smaller, though still appreciable number of blood samples analysed for inorganic phosphorus (364). The group of miscellaneous animal products includes 12 samples of liver from the Henderson Research Station which were analysed for copper and cobalt.

Feeds and Faeces from Feeding Trials. A certain proportion of the 1,473 samples of feeds and faeces from feeding and digestion trials at the Research Stations was analysed for chromic oxide only, while for some a complete feedstuff analysis was required. With 1,473 samples this is the largest single item in this section, and is an indication of the heavy demands made on the Branch by the major Research Stations.

Waters. The number of water samples analysed amounted to 207, which included 122 lysimeter leachate samples from the Matopos and Grasslands Research

Stations. Analyses were also performed on a number of borehole waters from the Sabi Valley, submitted by the Southern Rhodesia Division of Irrigation and Lands.

Toxicological Specimens. The number of toxicological specimens tested for the Veterinary Department during the year (657) was nearly the same as for the previous year (662). Of the 657 specimens tested 614 were for arsenic of which 352 specimens gave a positive result.

Cattle Dips. The total number of dip samples analysed during the past year (56) was approximately the same as in the previous year (59), although there was an increase from nine to 21 organic dips and a decrease from 50 to 35 arsenical dips.

SOIL TESTING SECTION

The soil-testing laboratory has functioned smoothly throughout the year and the standards of reproducibility in the routine determinations have been further raised to levels that were not thought to be obtainable when the methods were originally introduced. This is largely owing to the unremitting attention to detail in technique on the part of the analysts and their personal pride in their work, an attitude that is all the more praiseworthy because the routine is highly repetitive and frequently dull.

The number of samples received for normal advisory purposes (3,655) shows a marked decrease (20 per cent.) on the exceptionally high figure for 1958/59, but a slight increase (13 per cent.) on the figure for the previous year (1957/58). It is interesting to note that in 1957/58 the increase on the previous year was of the same order (15 per cent.), and it would therefore appear that there is a steady general expansion in demand for the service, although greatly increased demands may occur temporarily without warning and without any apparent reason.

On the other hand, samples received in connection with research projects and investigations (912) were 44 per cent. higher than in 1958/59 and 72 per cent. higher than in 1957/58. Such samples are analysed mainly in the summer months when few advisory samples are received This enables the laboratory to maintain a more level and efficient output and at the same time to provide a dual service to agriculture.

The marked seasonal character of the demands on the laboratory is the chief problem in efficient organization, and some delays in analysis are probably inevitable at the peak period in July. In the year under review these delays never assumed serious proportions and by early September they were completely eliminated.

The nature of the service provided is best illustrated by an analysis of the reports issued. During the year, 1,335 advisory reports were issued on 3,631 samples. Such reports include detailed assessments of the fertilizer and soil-amendment requirements for a wide range of crops and sometimes diagnosis of the cause of poor crop response. In addition soil-analysis reports were issued on 759 samples submitted for the purpose of compilation of scientific data or for correlation with response data from critical field experiments. Details are given in Table II, where samples upon which reports were issued are classified according to (a) the crop for which advice was required or the purpose that the report served, and (b) the territory from which the sample came.

Table III presents the salient features of this record, for advisory work only, and compares it with similar records for the two preceding years.

It is apparent that 70 per cent. of all advisory work is still concerned with the two principal crops, tobacco and maize, as might be expected, but each now accounts for a similar proportion of the work, whereas two years ago twice as many reports were made on tobacco soils as on maize soils. Section B of Table III indicates that advice was given on four and a half times as many soils from Southern Rhodesia as from Northern Rhodesia. According to information supplied by the Department of Conservation and Extension, this is also the ratio of land under cultivation in the two territories. The gratifying conclusion may therefore be drawn that farmers in Northern and Southern Rhodesia are making equal use of the soil-testing service.

Table II

SAMPLES UPON WHICH REPORTS WERE ISSUED (1959/60)

	Southern Rhodesia	Northern Rhodesia	Nyasaland	Foreigu	Total
ADVISORY:					
Tobacco: Flue-cured	1,040	161	—	13	1,214
Turkish	31	4	—	—	35
Other types	10	—	—	7	17
Seed-beds	27	1	—	—	28
Maize	834	409	—	—	1,243
Wheat	2	—	—	—	2
Potatoes	26	4	—	—	30
Other cash crops	33	11	—	—	44
Green-manure crops	18	7	—	—	25
Lucerne and fodder crops . .	80	5	—	—	85
Pastures	34	—	—	—	34
Market-garden crops	63	6	2	—	71
Fruit trees, vines, etc.	54	2	—	—	56
Sugar-cane	19	—	—	—	19
Tea and coffee	12	—	—	—	12
Other specialized crops . . .	5	—	—	—	5
Native rotations	62	—	—	—	62
Conservation and Extension demonstrations, etc. . . .	56	8	—	—	64
Private gardens	223	2	—	—	225
Sports clubs	34	—	—	—	34
Diagnosis & fertility assessment	74	5	—	—	79
pH tests and liming rates . .	138	24	—	—	162
Miscellaneous analyses . . .	85	—	—	—	85
TOTALS	2,960	649	2	20	3,631
*INVESTIGATORY:					
Chemistry Branch	259	—	—	—	259
Research and Specialist Services .	308	—	—	—	308
Conservation and Extension . .	40	2	—	—	42
Other Government departments .	4	—	—	4	8
Statutory bodies	127	—	—	—	127
Other scientific organizations . .	1	—	—	14	15
TOTALS	739	2	—	18	759
GRAND TOTALS .	3,699	651	2	38	4,390

* Includes only analyses for compilation of scientific data or for purposes of correlation with experimental data or field observations.

Table III

ADVISORY SAMPLES REPORTED: COMPARATIVE DATA

	Number and Percentage of Samples upon which Advisory Reports were Issued					
	1957/58		1958/59		1959/60	
A. *Nature of work*:						
Flue-cured tobacco .	1,347	51%	1,802	40%	1,214	33%
Maize	632	24%	1,405	31%	1,243	34%
Other crops	370	14%	689	15%	525	14%
*Miscellaneous . . .	298	11%	624	14%	649	18%
TOTAL . .	2,647		4,520		3,631	
B. *Country of origin*:						
Southern Rhodesia .	2,314	87·4%	3,642	80·6%	2,960	81·5%
Northern Rhodesia .	324	12·2%	791	17·5%	649	17·9%
Nyasaland	5	0·2%	11	0·2%	2	0·06%
Foreign	4	0·2%	76	1·7%	20	0·6%
TOTAL . .	2,647		4,520		3,631	

* "Miscellaneous" includes gardens, sports clubs, Conservation and Extension demonstrations, etc., and analyses for diagnostic purposes and for liming rates, etc.

SOIL SURVEY SECTION

The nature of the work of this section has been more varied in the past year than has hitherto been the case, and as a result a significant amount of new pedological data and knowledge has been acquired.

FIELD WORK

In the past, one or two long-duration, major surveys have normally taken up most of the field season, but the 1959/60 period was characterized by a variety of shorter duration investigations. A considerable proportion of these was in regions of high rainfall, mainly in the Eastern Districts of Southern Rhodesia. In all 20 different field investigations were completed. Of these the more extensive ones were the following:—

1. *Minor Native Department Irrigation Projects in the south-west of Southern Rhodesia.* In this investigation three separate small-scale projects on the Umzingwane River, ranging in size from 140 to about 1,000 acres, and a considerably larger project on the Shashi River, near its confluence with the Limpopo, were examined in order to assess their suitabilities for irrigation.

2. *Minor Native Department Irrigation Projects in the south and south-east of Southern Rhodesia.* Three schemes, Chilongas (1,700 acres) on the Lundi River, Malipati (2,800 acres) on the Nuanetsi River, and Chirwarakwara (3,200 acres) at the confluence of the Bubi and Limpopo Rivers, were examined for suitability for irrigation.

3. *Gwanda Special Native Area D* (Tuli Irrigation Project.) A broad reconnaissance covering an area of about 50 square miles was made in order to assess the irrigation potential involved in this project. The information regarding the soils in conjunction with that derived from an investigation into the availability of water from a feasible dam site on the Tuli River, will make it possible to assess the economics of the project.

4. *Stapleford Forest Reserve: Rupere Ridges.* Rupere ridge has an east-facing aspect and, in its length of 5½ miles, it slopes down steeply from a 6,000 foot peak to 2,500 feet in the Nyamkarara Valley. At the request of the Southern Rhodesia Forestry Commssion who wish to initiate experimental work there, a detailed survey of the crest of this ridge lying between the 6,000 and 4,900 foot contours was carried out. In addition, a broad reconnaissance of the more broken, lower part of the ridge and adjacent parts of the Nyamkarara Valley, was made.

5. *Melsetter Pasture Research Station.* A detailed soil survey of the station, excluding steeper slopes, was carried out.

6. *Comparison of the Tea-growing areas of Nyasaland and Southern Rhodesia.* This comparison involved an examination of the soils in all tea-growing areas (with the exception of New Year's Gift Farm) in Southern Rhodesia and some representative areas in the Cholo and Mlanje regions of Nyasaland.

7. *Erin Forest Reserve.* A detailed soil survey was carried out on two adjacent similar ridges in the Erin Forest Reserve as a result of experimental work being initiated by the Hydrology Co-ordinating Committee.

LABORATORY WORK

In the year under review pedologists returned to the laboratory at an earlier date than usual and as a result a number of soil samples taken during the past field season were analysed before 30th September, to give a record total of 286 fully analysed samples. Of these, 192 were from surveys conducted by the section in both the past and the previous years' field seasons.

Analyses of 36 samples were made for Sir Alexander Gibb and Partners, who have completed a soil survey with the object of extending the acreage under cane at the Chirundu Sugar Estates. The remaining 58 samples were taken by soil survey pedologists during a general pedological reconnaissance in Southern Rhodesia in 1955 and it was only within the last year that time became available to carry out these analyses.

OTHER ACTIVITIES

The Senior Officer and Mr. A. A. du Toit investigated the question of water infiltration rates and hydraulic conductivity in soils and developed methods of their determination. Since measurements of this nature must, of necessity, be somewhat empirical, procedures have been worked out for making measurements of hydraulic conductivity of distured soil samples in the laboratory, as well as for determining water infiltration rate and hydraulic conductivity of soils and soil horizons in the field.

Among the visitors to the section was the Assistant Director of the Inter-African Pedological Service. Tours of pedogenetically varied areas were made in both Southern Rhodesia and Northern Rhodesia in order to familiarize the Assistant Director with our soils and their genesis. As a result of these tours certain important changes in the legend of the preliminary draft of the soils map of Africa were recommended.

In collaboration with pedologists from Northern Rhodesia and Nyasaland the Senior Officer compiled a generalized soil map of the Federation for inclusion in the Federal Atlas.

RESEARCH SECTION

Soil Organic Matter Studies

(a). *Biological activity and organic matter levels in cultivated soils.* Further studies of the organic matter levels and biological activity in red clays and sands were carried out with a view to assessing the effect of different rotational and cultural practices.

It is apparent that further studies of the nature of soil organic matter, particularly in sandveld soils, would be of interest, possibly using flotation techniques to separate "coarse" organic matter from that associated with soil colloids.

(b) *Effect of soil drying upon rate of breakdown of soil nitrogen.* Following Birch's findings in Kenya of a more rapid release of nitrogen in soils after drying, and in view of our observations that increased release of nitrogen may occur following prolonged storage of air-dry soils, a series of soils from the Salisbury Agricultural Experiment Station have been studied throughout the year to ascertain the effect of drying in the field (during dry spells and over the dry season) on release of available soil nitrogen.

It was found that dry spells during the rainy season (even when the soil dropped well below wilting point for a prolonged period) did not have any appreciable effect on the rate of release of nitrogen upon rewetting the soil. Only when the soils reached an air-dry condition (after ploughing at the end of the dry season) was any appreciable increase in rate of release of nitrogen upon re-wetting observed. This work is being continued.

Phosphate Availability Studies

The use of anion exchange resins for the extraction of available soil phosphorus was further investigated. The cause of the difficulty experienced previously in obtaining good extraction and reproducibility was discovered. It was found that free salts retained on the resin after regeneration severely interfered with the transfer of phosphate through the three-phase soil-water-resin system. By taking precautions to wash the resin completely free of acid, much better and more reproducible extraction was obtained.

Using the modified method, all available soil samples from phosphate trials have been analysed and the data correlated with crop response. The resin procedure has been found to be clearly superior to the alkali extraction procedure developed some years ago and now used as routine.

Details of the method and results obtained are now being prepared for publication.

Minor Elements

The minor element survey of Southern Rhodesia based on grass samples collected in 1953 and maize and lucerne in 1958 has been completed with the determinations of copper and zinc in 55 samples and their corresponding soils. The results have not been finally evaluated but it is apparent that total copper is higher in red clay soils than in granite sands. However, available copper, and the copper content of plants are not so strongly dependent on soil type. In view of the low copper content of many local plant samples and of the importance of copper in animal as well as crop nutrition, further work on the copper status of pastures and arable crops is necessary.

Both total and available zinc were found independent of soil type and available soil zinc was correlated with the zinc content of the plants. However, there are indications that available zinc in the soil is a better indicator of deficency than the zinc content of the whole plant. Cases of zinc deficiency in maize in the Lusaka district have been identified by plant symptoms and the low level of zinc in soil and plants, and it is reported that the maize has responded to zinc sulphate.

Work on available molybdenum was continued, and it was confirmed that crops grown on red clay soils had a much lower molybdenum content than those on granite sands in spite of the high level of chemically-extractable molybdenum in the red soil. No suitable chemical extractant has been found. By overseas values the molybdenum content of the crops is very low and molybdenum nutrition merits further studies.

For these and other trace element investigations a purely chemical approach is of limited value and it is essential that proper greenhouse facilities be obtained to allow for plant studies under controlled conditions.

INFERTILITY OF SANDVELD SOILS

Investigations into the infertility of sandveld soils have been continued. Comparisons have been made of soil and leaf samples from patches of good and poor growth of maize, tobacco, soybeans, and lucerne. The common factor in all cases of poor growth has been soil acidity, and a low content of exchangeable bases. Acidity is not however the sole factor, and it appears that in some cases the infertility is caused by multiple nutrient deficiencies or by other environmental factors, such as unfavourable physical soil conditions.

Typical instances of infertility caused by soil acidity have been found at the Grasslands Research Station where the soil had become acid through application of ammonium sulphate to a ley. The following maize crops showed a distinct response to lime though in a few plots sub-soil acidity appeared to limit yields. In these soils a very close relationship has been established between soil pH and soluble aluminium, which increases rapidly in lower pH levels.

Data available suggests that yields, particularly of lucerne, are more strongly affected by soluble aluminium than by a low pH; this point is being studied further.

Multiple deficiency has been found to cause crop failures on leached Kalahari sand in the Beatrice district. In field experiments little response has been obtained to the major nutrients, trace elements or lime.

The calcium content of samples of maize and tobacco from good and bad patches in both limed and unlimed lands, though low throughout, was not affected by liming but was always higher in the good crop. The copper and boron contents were decreased by liming and were lower in the good crop than the poor. A greenhouse experiment showed that the soil was severely deficient in boron, and indicated a strong interaction between response to lime and a trace element mixture. There was a slight response to soluble calcium, and the possibility of trace elements other than boron being deficient is currently being studied in the greenhouse.

Little information is, as yet, available concerning the effect of other environmental factors, such as unfavourable physical soil conditions. In a greenhouse experiment with a poor acid granite sand, which had been worked to a good structure and treated with heavy application of superphosphate, satisfactory growth of maize and soybeans was obtained irrespective of the soil's lime status.

SPECTROGRAPHIC TECHNIQUES

Considerable progress has been made in the development of improved spectrographic techniques for the determination of certain important trace elements. Without laborious and tedious concentration procedures the determination of zinc and molybdenum in plant material by normal spectrographic procedures is difficult, if not impossible. A good deal of time has therefore been spent in developing methods for including zinc and molybdenum in routine determinations.

As a result of this work, a method has been developed for the simultaneous determination in plant ash of calcium, magnesium, sodium, copper, manganese, zinc, nickel, chromium, aluminium and iron. With the adoption of certain new procedures a thirty-fold increase in sensitivity of the determination of zinc has been achieved. A greatly simplified concentration procedure for the determination of molybdenum and cobalt in plant ash has been developed. It is now possible to do a complete trace element analysis by means of two relatively rapid determinations, representing a very considerable saving of time compared with most spectrographic procedures used elsewhere.

Soil Physics

The great importance of initiating a programme of research in soil physics for dryland as well as irrigated crops has long been realized. Arrangements have been made to transfer the Soil Physicist, seconded to the Sabi Valley Experiment Station, back to Salisbury in order to undertake this work, and a chemist was transferred to the Sabi Valley Experiment Station to take over the duties of the present Soil Physicist before his transfer to Salisbury.

In the Salisbury laboratory determination of the soil moisture characteristics of particular soils was continued. Some physical observations have been made on soils from the Kafue Pilot Polder scheme where numerous patches of poor growth have been observed in the wheat. It has been found that these patches are due to poor aeration and it has been suggested that crops should be grown on ridges and irrigation carried out in the furrows in order to improve aeration.

Advisory Work

A considerable number of plant samples have been analysed for suspected minor element deficiencies and there is a danger that this work may come to be regarded as an analytical service available to all. However, neither the facilities, nor the necessary information on which such a service could be based, are available and work of this nature can be done only in order to obtain possible information on the incidence of deficiencies in different areas.

It is of interest to note that some cases of copper deficiency were thought to have been detected. As usual a number of cases of boron deficiency were found. Symptoms similar to those reported as being due to zinc deficiency in Nyasaland were investigated in experimental coffee plantations in the Honde Valley; they were thought to be largely due to lack of shading but there was a possibility that they may also have been due to other nutrient imbalances. During the past season blanching of the growing tips of maize was frequently observed and was in most cases found to be associated with acid soils and with a high aluminium content in the plant.

In addition, investigations were carried out for the C.I.D. with a view to characterizing particular bullets and pieces of cotton.

Correlation of Crop Responses With Soil Analytical Data

A critical reappraisal of the interpretive criteria used for making fertilizer recommendations is long overdue. Some time has been spent on the collection of data from field trials conducted by the Research Stations of the Department and of the Tobacco Research Board and by the Department of Conservation and Extension with a view to correlating them with the soil data but this work is more seriously in arrears than ever.

The task is a very considerable one but it has not been possible to spare staff from present commitments for this, and it is doubtful whether much progress can be made without the assistance of additional staff.

This is a matter of considerable concern since the value of recommendations given to farmers depends on regular re-examination of the criteria in the light of experimental data, and since such a re-examination may be expected to result in considerable improvements in the interpretation of soil analysis in terms of fertilizer recommendations.

PUBLICATIONS

1. Chemistry Branch.—"What Form of Nitrogen Shall I Use?" *The Rhodesian Farmer,* 31, 46, 1960.
2. Saunder, D. H.—"What is the Value of Green-manuring in Rhodesia?" Proceedings of the Fourth Annual Conference of the Professional Officers of the Department of Research and Specialist Services, 70-81, 1959.
3. Saunder, D. H.—"Laboratory Incubation Studies to Determine the Rates of Mineralization of Nitrogen and Carbon in Rhodesian Soils." Third Inter-African Soils Conference, Dalaba, 1959.
4. Saunder, D. H.—"Maintenance of Soil Productivity Under Annual or Perennial Crops." Rapporteur's report. Third Inter-African Soils Conference. Dalaba, 1959.
5. Soane, B. D.—"Soil, Water and Plant Relations." *Rhodesia Agricultural Journal,* 57, 46-51, 1960.

6. Soane, B. D.—"Construction and Use of a Cheap Tensiometer for Research Workers." *Rhodesia Agricultural Journal*, 57, 244-250, 1960.

7. Soane, B. D. and Saunder, D. H.—"Nickel and Chromium Toxicity of Serpentine Soils in Southern Rhodesia." *Soil Science*, 88, 322-330, 1959.

8. Thomas, R. G.—"Classification of Soils for Land-use Purposes in the Rhodesias. Soil Classification and Mapping." Third Inter-African Soils Conference, Dalaba, 1959.

9. Thomas, R. G. and Thompson, J. G.—"The Classification and Assessment of Soils for Irrigation in Southern Rhodesia." Third Inter-African Soils Conference, Dalaba, 1959.

10. Thompson, J. G.—"A Description of the Growth Habits of Mopani in Relation to Soil and Climatic Conditions." Proceedings of the First Federal Science Congress, 1960.

11. Vincent, V. and Thomas, R. G.—*Agricultural Survey of Southern Rhodesia*, Part I. Agro-ecological Survey (in the Press).

12. Weinmann, H.—"Nitrogen Fixation in Legumes." Proceedings of the Fourth Annual Conference of the Professional Officers of the Department of Research and Specialist Services, 3-9, 1959.

13. Weinmann, H.—"Potato Production, V." Nutrient requirements. *Rhodesia Agricultural Journal*, 57, 56-58, 1960.

14. Weinmann, H.—"Chemical Composition and Nutrient Uptake of Flue-cured Virginia Tobacco Grown on Rhodesian Granite Sandveld." Proceedings of the First Federal Science Congress, 1960.

ENTOMOLOGY BRANCH

J. A. WHELLAN, *Chief Entomologist*

INTRODUCTION

There were again a number of staff changes, particularly in professional staff, so that for the entire year the Branch was below full strength. Mr. Smithers, Entomologist, resigned to take up an appointment in the Sydney Museum, Australia, and Mr. Hewitt, who had been working in close association with the Grain Marketing Board, resigned to take up a scholarship for further study in the United States. Towards the end of the year replacement entomologists, Messrs. Borthwick and Wilson, joined the staff. These changes have unfortunately meant that there has been a break in the continuity of the entomological research carried out with the Grain Marketing Board, though—as Mr. J. Pearson, of the Pest Infestation Laboratory, has remained with the Grain Marketing Board—the Board has not been deprived completely of professional advice.

The Chief Entomologist represented the Federation at the 4th Meeting of the Inter-African Phytosanitary Commission held in London in October, 1959. He also attended meetings of the Rhodesia Tobacco Association Fumigation Sub-Committee, which were mainly concerned with the need for erecting a vacuum fumigation chamber either at Salisbury or Beira. During the year a sub-committee of the Rhodesia Standards Association, to deal with pesticides, was formed and the Chief Entomologist attended the first meeting of this. Unfortunately, owing to illness, the Chief Entomologist was unable to attend the meeting of the International Red Locust Control Service Council held at Abercorn in July, and this is the first year that the Federation has not had direct representation at these meetings. In April Dr. F. J. Simmonds, Director of the Commonwealth Institute of Biological Control, paid a short visit to the Federation and was taken to Umtali to see the extent of the lantana problem there. The possibility of establishing a station of the Institute in East Africa was also discussed. Such a station would undertake work for the Federation and other African territories.

INVESTIGATIONS AND RESEARCH

Pink Bollworm

Following the discovery of pink bollworm in the Sabi Valley last year, steps were taken to reduce its incidence or, if possible, to eradicate it. This included the publication of regulations designed to ensure that there would be no cotton plants in the area of pink bollworm infestation during the months of August and September so that so far as possible pink bollworm would be starved out in this period. Observations showed that unlike its habits in other parts of the world in similar latitudes, pink bollworm in Southern Rhodesia in the larval stage seemed unable to enter a long diapause, which would enable it to carry-over the adverse dry season. It was thus dependent on either the continued existence of cotton plants, including trash, or the continued existence of alternative host plants. A survey of debris disclosed five living larvae ten days after the crop had been removed and the land ploughed. Carry-over in cotton plants was prevented by regulations enforcing destruction of plants after harvest and setting an earliest planting date so that a gap of two months was ensured. A survey of possible alternative host plants was made and it was found that only *Hibiscus dongolensis* was of any significance. This plant seemed, however, to be of special importance in that pink bollworm appeared to be able to breed in it almost, if not quite, as freely as in cotton; this is of interest, as in most other parts of Africa pink bollworm seems to be dependent on cotton and alternative host plants seem to be of very little importance. *Hibiscus dongolensis* is widespread in the Sabi area, commonly in lands which have been disturbed at some time in their recent history by cultivation, cattle grazing, roadmaking or other means. It is fortunately an easily recognizable plant and readily seen at some distance when in flower. It was, therefore, decided to make a survey of the distribution of *Hibiscus dongolensis* in the infested area and if this gave promising results, to attempt to eradicate it in that area. In the event the results were promising and *Hibiscus dongolensis* was cut out by a team of African labourers over a wide area in the region of known pink bollworm infestation. The result of these measures has been that in 1960 pink bollworm infestation in cotton has been much lower than it was in 1959 and no spread has been recorded. It is still present, however, and to prevent the spread in seed cotton all such cotton leaving the area is subjected to fumigation with methyl bromide before it leaves. Examination of the fumigated cotton has in several cases shown the presence of dead pink bollworm larvae, so that it is clear that the measures taken have been necessary and will have to be continued for some time to come.

At the invitation of the Portuguese, an entomologist, Mr. Carnegie, paid a visit to the cotton-growing areas in the neighbourhood of Espungabera, which is the nearest known cotton to the Sabi infested areas. It had been thought that as pink bollworm is known to occur in Moçambique its origin in the Sabi Valley might have been found in these areas, but the survey made did not disclose any pink bollworm in these, the nearest cotton growing areas of Portuguese East Africa to the Sabi Valley.

Fruit Flies

Ten species, including some melon flies, have been found in the Umtali area. Five of these have been identified tentatively and the most common fruit fly appears to be the Natal fruit fly (called variously *Pterandrus rosa,* and *Ceratitis rosa),* and the most common melon fly a species of *Dacus* (probably *D. ciliatus*). No specimen conforming to the description of the Mediterranean fruit fly *(Ceratitis capitata)* has yet been taken, although in literature this is stated to be common.

Fruit fly is more common at lower altitudes and under warmer conditions and is particularly troublesome in towns and heavily populated areas, probably owing to relative abundance of alternative hosts. However, specimens of Natal fruit fly *(P. rosa)* have been reared from infested raspberries from Claremont Estate, Inyanga, and from a peach from Newbold Orchards, Odzani. But most specimens have come from lower areas, which is probably why one has the impression that peaches and guavas are more susceptible than other fruits.

Reports this year suggested that fruit fly had caused less damage than in previous recent years, and this may have been due to conscientious baiting, which many farmers have carried out. However, in and around Umtali it seems impossible to reap a crop from late peach varieties even where baiting is carried out. In townships, reinvasion by adult flies must be very rapid.

Small-scale experiments to compare the merits of commercially produced lures made from soluble fish extracts and ordinary sugar baits have been made. But large-scale field experiments have been impossible owing to the lack of suitable orchards. It is possible that two peach orchards in the Cashel area may be made available this year for experiments. Laboratory experiments, in which Natal fruit flies, *Pterandrus rosa,* were given a choice of soluble fish extract bait and sugar bait indicated a preference for commercially produced soluble fish baits.

Fruit-piercing Moths

Fruit-piercing moths were not abundant last season and no great damage was reported. Nocturnal visits to vineyards in the Rusape and Umtali areas yielded nine specimens feeding on grapes. These included *Cyligramma latona* Cram., *Ophideres fullonica* L., *Ophideres materna* L., *Achaea catella* Guen, *Achaea lienardi* Boisdv., *Achaea* sp., and one unidentified moth on a mango.

An owner of one of the farms achieved some control by distributing tins of malathion sugar-bait in the vineyards.

Woolly Apple Aphis *(Eriosoma Lanigerum)*

A year's monthly population counts of woolly aphis at Inyanga had to be concluded in May, 1960, when the property under observation was due to be subdivided and sold. Eighteen trees were used. Six were treated with two sprays of metasystox, six treated with two sprays of Rogor 40, and six left untreated. Both treatments showed substantial initial control followed by an increase, probably due to reinfestation from the populations on the roots which were not affected by the spray.

Bean Stem Maggot

Earlier investigations (Taylor, 1959) showed that insecticidal treatment of seeds of beans before planting gave protection against attacks by the bean stem maggot. These trials were extended this year and it was found that if the seeds were treated with diluted dieldrin emulsion, soaked for a longer period in more dilute emulsion or treated with a slurry of dieldrin wettable powder, protection was given from attack by the maggots. An attempt to find the mode of operation of this protection was made. Feeding marks and egg-laying punctures were found on the leaves of treated control plants alike. On treated plants young maggots could be found in the leaves and petioles, but they seemed never to succeed in penetrating the stem. Thus it was deduced that the insecticidal treatments, between which there seemed nothing to choose, did not protect the plants from attack by the adult flies but—perhaps by some systemic action—protected the stem from invasion by its larvae. An unexpected result was that yields from the treated, and therefore uninfested, plants were no higher than from the infested controls. This may have been due to the failure in the control plants of secondary roots—which are the main direct cause of loss—to develop or to generally favourable growth conditions enabling the bean plants to outgrow the attack.

MAIZE STREAK

Owing to an increase in the incidence of maize streak, attempts were made to discover more about the insect vectors of this disease in Southern Rhodesia.

Several outbreaks occurred in irrigated maize grown on the Sabi Development Farm, Sabi Valley, and affected plants were examined for insect vectors. Large number of the fulgarid, *Peregrinus maidis* Ashm. were found sheltering beneath the bases of leaves. As past records have associated this fulgarid with streak-infested plants, this insect was checked to determine whether it could transmit streak from infested to healthy plants. All attempts to do so failed and it was concluded that *Peregrinus maidis* is not a vector of maize streak.

Large number of Jassids collected from maize and surrounding grass verges were also screened as possible vectors using the glass-tube technique described by Storey (1925) (Ann. Appl. Biol. Vol. 12). An infested maize streak plant was planted in the insectary at Salisbury. Possible insect vectors were confined on the streak-infested plant for three days before being transferred to healthy seedlings for a similar period of time. All insects tested were sent to the Commonwealth Institute for confirmation of identity. All insects tested failed to transmit maize streak.

As it has been shown that various *Cicadulina* spp. are vectors of maize streak in East Africa and the Union of South Africa, attempts have been made to discover whether they transmit the disease in Rhodesia. All attempts so far have failed due to the early death of all examples collected. Attempts are now being made to discover the distribution of *Cicadulina* spp. in Southern Rhodesia. Screening of other possible vectors is being abandoned until a better knowledge is available of the habits of *Cicadulina* spp. under local conditions and in the vicinity of maize lands.

WHITE GRUBS (*Eulepida Mashona Arrow*)

During November, 1957, a trial was laid down at Grasslands Research Station, Marandellas, to compare various soil insecticide treatments as a measure for the control of white grubs in the establishment of ley pastures. The treatments included dieldrin applied at the rate of 1, 2 and 4 lb. actual insecticide per acre and DDT at 2, 4 and 8 lb. actual insecticide per acre and control untreated plots. The trial was in a field of grass ploughed during the winter and reseeded as a ley pasture of Katambora Rhodes Grass, *Chloris gayana* (Kunth), in November, 1957. The insecticides were broadcast and lightly disced into the soil. The results of two years' observations have been published. (Taylor and Smithers, 1959, R.A.J. Vol. 56, No. 6). All treatments were shown to have some value in controlling white grub infestation and in giving protection to establishment of the ley. Dieldrin was found to give better protection than DDT.

Further observations were made during March, 1960, in order to determine whether the treatments continued to give protection to the established ley. It was clearly demonstrated that all treatments continued to give protection in the third year after treatments. The overall level of infestation was low and differences could not be detected between swards established in the experimental plots.

STORED MAIZE PESTS

An entomologist worked with the Grain Marketing Board until June, 1960. He was concerned in particular with the investigations into methods of applying insecticides to stacks of grain and grain stores and with measurements of the residual action and efficiency of insecticides in use.

Malathion insecticides applied as an emulsion formulation was being widely used in Grain Marketing Board stores as a measure for protecting stacks from reinfestation after initial fumigation with methyl bromide. Various levels of application in emulsion and wettable powder formulation were tested using stock cultures of *Calandra oryzae* and *Tribolium* spp. Trials were repeated in the laboratory and with experimental stacks of grain. As a result of these investigations it was decided that wettable powder formulations were more effective than emulsions and that a deposit of 100 mgm. per square foot of technical malathion was required to give an effective residual action of one month under field conditions. The routine pest control spray programme of the Grain Marketing Board was modified accordingly.

Various methods of applying insecticide sprays were tested and a spray boom was devised to give an even spray pattern when lowered down the sides of grain stacks. It had been realized that conventional applications of sprays fail to give even cover, particularly in crevices between bags.

Other investigations started concerned bionomics of grain moths, *Plodia interpunctella* and *Ephestia elutella*, and their control.

CORN ROOT WORM (*Apophyllia murina*)

During January, 1960, an extended survey was made in most of the maize-growing areas of Northern Rhodesia on the line of rail from Choma to Broken Hill. The survey indicated that damage caused by the corn root worm was widespread. Important losses were caused to plants soon after germination. As a result of the survey, insecticide trials and investigations into the biology and life cycle of this pest were planned for the 1960-61 season.

PESTS OF LUCERNE

With the resignation of Mr. Smithers, work on this subject was suspended, but it is hoped to resume it in the near future. Meanwhile the associated insects have been sent to the Commonwealth Institute of Entomology for determination.

HELMINTHOLOGY

During the year, well over 2,000 root systems were examined for the presence of plant parasitic nematodes, necessitating the preparation and identification of approximately 8,000 females belonging to the *Meloidogyne* or root-knot nematode genus of parasitic nematodes.

In addition 75 x 1 lb. soil samples were processed and the plant parasitic nematodes recovered were identified to the genera and differential, and total estimates of the numbers present were made.

Meloidogyne spp., DISTRIBUTION

M. javanica is widely distributed throughout Southern and Northern Rhodesia and the Southern Province of Nyasaland. *M. hapla, M. arenaria* and *M. incognita* var. *acrita* are, except in a few instances, restricted to areas other than virgin and dry farming lands. *M. hapla* is more prevalent in the Eastern Highlands of Southern Rhodesia than elsewhere and *M. arenaria* was found in 30 per cent. of the tea nurseries examined in the Southern Province of Nyasaland. Little information is available from the Central and Northern Provinces of Nyasaland and Barotseland.

WATTLE

The survey of root-knot nematode infection on wattle growing in the Eastern Highlands continued from the previous year. Specimens were received from 251 blocks of wattle from ten estates and all but 46 were found to be infected. The species of root-knot nematodes involved are *M. javanica* and *M. arenaria*, the latter occurring only occasionally. A total of 540 blocks of wattle plantations have now been examined and 86.5 per cent. have been found to be infected.

LEGUMES — *M. javanica* SUSCEPTIBILITY TRIALS

A high degree of susceptibility was found in all but five of the 107 species and varieties of legumes (mainly clovers) grown on heavily infested land at Grasslands Experiment Station. Five of the six varieties of *Lotus corniculatus* grown in the trials had lower root-knot indices than any of the other test plants examined, most of which belonged to the genus *Trifolium*.

TOBACCO — *Meloidogyne* spp., SURVEY IN NYASALAND

Tobacco seedlings from government-controlled seed-beds in 37 different areas were received from Nyasaland. *M. arenaria* was recovered from two root systems and *M. javanica* was present in all of the other specimens examined.

TEA — PLANT PARASITIC NEMATODE SURVEY IN NYASALAND

A survey was made of plant parasitic nematodes occurring in association with tea plants growing in the Southern Province of Nyasaland. *Meloidogyne* spp. were found to be widespread in the nurseries, resulting in one case in an almost total loss of seedlings. Only three infections were found in mature tea bushes and in each case the attack was light. In 70 per cent. of the infection in nurseries, the species involved was *M. javanica*, the remainder, with exception of a single case of *M. incognita* var. *acrita*, were due to *M. arenaria*. Only *M. javanica* was found on mature tea.

In addition to the *Meloidogyne* spp. present, 14 known genera and several new forms of plant parasitic nematodes were recovered from soil in the root zones of tea plants.

PARASITIC NEMATODE SURVEY IN THE NORTH-WESTERN PROVINCE OF NORTHERN RHODESIA

M. javanica was found to be widespread in African-grown crops in the North-Western Province of Northern Rhodesia. Only one case each of *M. arenaria* and *M. incognita* var. *acrita* was found. In addition, 20 known genera and several new forms of plant parasitic nematodes were recovered from soil taken from the root zones of growing plants.

WHEAT — PLANT PARASITIC NEMATODES IN THE RHODESIAN SELECTION TRUST KAFUE POLDER SCHEME

Thrifty and unthrifty wheat plants, and the soil in which they were growing, were examined for plant parasitic nemas. No parasitic forms were recovered from the actual plants and only four genera of parasitic nemas were found in the soil. There was no evidence of the poor growth in the wheat being attributable to the presence of plant parasitic nematodes.

M. javanica — LONGEVITY EXPERIMENT

Nematode survival, gauged by galling of tomato roots planted after two years bare fallow, was sufficient to cause light infections.

M. javanica — CHEMICAL CONTROL EXPERIMENTS

Experimental Nematicide 18,133 (0.0-diethyl 0-2-pyrazinyl phosphorothioate) supplied by the American Cyanamid Company was used in field plot trials without success.

POTATO VARIETIES MAINTENANCE AREA — ROOT-KNOT NEMATODES

No signs of *Meloidogyne* spp. infection were observed in roots and tubers of 50 test plants grown at widely spaced intervals on a selected site situated above the Mare Dam at Inyanga. This site will probably be used by the Potato Breeder for the maintenance of his potato variety stocks.

SCREENING OF FRUIT TREE ROOT-STOCKS FOR *Meloidogyne* spp. SUSCEPTIBILITY AT RHODES INYANGA ORCHARDS

By growing susceptible crops, soil populations of both *M. javanica* and *M. arenaria* are being increased in Orchard No. 1 at Rhodes Inyanga Orchards. When the populations are high, screening trials will be carried out using many varieties of root-stocks.

GRAPEVINES

A small area, on a farm situated near Umtali, known to be heavily infested with *M. javanica*, has been planted to several varieties of grapevines. The root systems will eventually be checked for infection and graded for galling to see whether any varieties are resistant.

Unthrifty vines grown by Mr. Day at Rusape were found to be heavily infected with *Criconemoides* sp., it is hoped that this can be investigated.

HOST-PARASITE (*Meloidogyne* spp.) RELATIONSHIPS

Inexplicably, the soil populations of the four experimental pure line infestations of the *Meloidogyne* spp. found in the Federation dropped to a very low level, so that no useful information on host plant susceptibility was obtained. An attempt is being made to resuscitate the infestations with a view to making further trials.

BLOCK 39, SALISBURY EXPERIMENT STATION — *M. arenaria*

Potatoes grown on Block 39 during the 1958-59 season were found to be infected with *M. arenaria*. This block was planted, during the 1959-60 season, to sunflowers in order that the distribution of the parasite within the block could be plotted. The infestation was found to be confined to one corner of the land and therefore the block is unfortunately unsuitable for host trial work.

HATCHING TESTS WITH *M. javanica* EGG MASSES

Sodium chloride. Inhibition of hatching of embryos from eggs within the mass was brought about by immersion of the masses for 300 days in 2 per cent. NaCl solution; such treatment did not prevent subsequent normal emergence when transferred to distilled water.

E.N. 18,133. Using a 1 in 34,000 dilution of 5 per cent. granular E.N. 18,133, it was found that embryos within the eggs in the mass did not hatch, but on transfer to water normal hatching occurred. When, however, the immersion in the chemical solution was prolonged for 27 and 38 days greatly reduced hatching occurred on transfer to water.

ADVISORY SERVICE

Recorded inquiries at Salisbury numbered 349 and at Umtali 194. There were no particularly severe outbreaks of any particular pest. It is surprising that the outbreak of army worm, severe over wide areas of the Union of South Africa, had no counterpart here, only isolated occurrences being recorded.

Maize stem borer and potato tuber moth were of about average incidence, there was rather more than usual damage due to bean stem maggot and late in the season green bush locusts were very troublesome, mainly in gardens. Several reports of damage to tomato fruits by looper caterpillars were received and one of these, from Cashel, proved due to *Phytometra chalcytes*. It is not known whether other species of the large genus Phytometra, the larvae of which are generally considered leaf-eaters, may cause the same damage. Trouble due to various species of mites has again been on the increase and an eriophyid, *Phyllocoptes destructor*, was prevalent in the Umtali area causing considerable damage to tomato plants. In the winter the lesser army worm, *Laphygma exigua*, was much more prevalent than usual and caused a great deal of damage, to peas especially but also to lucerne and other irrigated crops. In September heavy damage to pines at Stapleford was reported. This was due to the larvae of a moth, *Orgyia basalis*, not known as a pest previously. They had caused defoliation of about 100 acres of well-grown *Pinus patuala*.

PHYTOSANITARY SERVICES

A revision of the Plant Pests and Diseases (Importation) Regulations, which incorporated the recommendations of the fifth meeting of the Inter-African Phytosanitary Commission, and some minor amendments, were published. One of these concerned heather as it was discovered that it was the custom to import this—in itself innocuous—plant packed with raw potato which could lead to the inadvertent introduction of wart disease or potato root eelworm amongst other things. Several interceptions of heather so packed were subsequently made. There is still difficulty in ensuring that the provisions of these regulations are enforced in the northern territories due to the absence there of trained staff.

Altogether 817 permits for importations were issued during the year. The Plant Inspectors at Salisbury, Bulawayo and Umtali dealt with 32,562 consignments, including 1,506,679 packages of plant material, both amounts being increases over last year.

One consignment of water hyacinth *(Eichhornia)* was intercepted at Bulawayo and destroyed in terms of the Noxious Weeds Act.

Fruit from South Africa was in general of good quality and very little had to be refused entry or sorted due to pest infestation.

Citrus fruit exported from the Umtali area to Europe was examined and certified.

Cotton passing through the Federation from the Espungabera area and out again at Umtali was inspected and in all cases was found free of pink bollworm. Some 400 tons was involved.

Fruit grown in the Eastern Districts was inspected and graded by the Plant Inspectors on behalf of the Senior Horticulturist and, to help the Economics Branch in compiling their statistics, detailed records of imports of citrus were kept.

The number of registered nurseries in the Federation showed a slight decline to 66. Most were inspected, though restricted travelling made this impossible for some. There has been a considerable improvement in the standard of hygiene in nurseries generally.

The number of phytosanitary certificates issued in respect of plants for export rose to 261. Many of these were in respect of cured tobacco—both samples and large consignments.

Tobacco premises licences issued rose slightly to 81. Inspections of tobacco premises rose slightly to 4,970. This included two inspections of most farms other than those in the eastern part of Southern Rhodesia, where this was not possible due to the protracted illness of the inspector. The policy of inspecting warehouses, storage sheds and packing rooms more frequently was continued and these were inspected at least four times. The tobacco sheds at Beira were inspected three times. An inspector to work specifically in Northern Rhodesia was appointed towards the end of the year, bringing the total inspection staff to seven.

Nineteen infestations of cigarette beetle were detected and the premises concerned were all fumigated with methyl bromide and treated with DDT and were reinspected to ensure that the treatments had been adequate. On each of the three inspections at Beira some consignments were found to be infested. These also were fumigated with methyl bromide.

Sixteen prosecutions were made against farmers who had not properly destroyed tobacco plants by the appropriate dates and all resulted in fines being levied.

Inspections of fumigated cotton in the Sabi Valley were carried out on our behalf by an officer at the Sabi Valley Experiment Station. Altogether 64 inspections were made and in several cases dead pink bollworm larvae were found to be present after fumigation.

PUBLICATIONS

PAPERS

1. "The Biology and Control of White Grubs in Ley Pastures", by C. E. Taylor and C. N. Smithers. *R.A.J.*, Vol. 56, No. 6, 1959.
2. "Plants attacked by Root-knot Nematodes in the Federation of Rhodesia and Nyasaland. Supplementary List No. 1 By G. C. Martin. *R.A.J.*, Vol. 57, No. 2, 1960.
3. "Rhodesian Aphids of Economic Importance", by C. E. Taylor, *R.A.J.*, Vol. 57, No. 4, 1960.
4. "Some Recent Observations on *Busseala furea*" (Fuller) (Lep. Noctuidae) in Southern Rhodesia", by C. N. Smithers. Bull. Ent. Res, Vol. 50, Pt. 4, 1960.
5. "The Root-knot Nematode in Central Africa", by G. C. Martin. S.P.A.N. Vol. 3, No. 3.
6. "A list of the Mecoptera of Southern Rhodesia, with the Description of a New Species and Key", by C. N. Smithers. Proc. R. Ent. Soc., Series B., Vol. 28, Dec., 59.
7. "A New Species and Additional Records of Mecoptera from Southern Rhodesia", by C. N. Smithers. J. Ent. Soc. S. Africa, Vol. 23, No. 1, 1960.
8. "Preliminary Observations on *Colias electo* L. in Southern Rhodesia", by C. N. Smithers. J. Ent. Soc. of S. Africa, Vol. 23, No. 1, 1960.
9. "A Collection of Psocoptera from Australian Chestnut Trees in Natal, South Africa", by C. N. Smithers. J. Ent. Soc. S. Africa, Vol. 23, No. 1, 1960.
10. "Preliminary Remarks on Insects Associated with Lucerne in Southern Rhodesia", by C. N. Smithers. Proc. of 4th Ann. Conference of Prof. Officers of Dept. Res. & S.S. 9 (Pub. 1960).

11. "Importance of Eelworm in the Production of Legumes in the Federation", by G. C. Martin. Proc. 4th Ann. Conf. of Prof. Off. of D.R. and S.S. (Pub. 1960).

REVIEWS IN *Rhodesia Agricultural Journal* (*by J. A. Whellan*)

1. "A Review of the Biological Control of Insect and Weeds in Australia and Australian New Guinea", by F. W. Wilson.
2. "Agricultural Insects of East Africa", by R. H. Le Pelley.
3. *Flora Zambesiaca,* Vol. 1, Pt. 1, by A. W. Exell and H. Wild.

ABSTRACTS IN *Rhodesia Agricultural Journal* (*by J. A. Whellan*)

1. "Observations on the Termites affecting Tea in North East India and their Control", by G. M. Das.
2. "Seed-dressing against the Black Wheat Beetle *(Heteronychus* spp.) in Kenya", by Graham, Bullock and Peers.

HORTICULTURE

C. N. HAYTER, *Senior Horticulturist*

A marked improvement in production, with more regular and sustained supplies to markets, of both fruits and vegetables occurred throughout the year. Growers were far more conscious of continuity of supply and the necessity for planned successional cropping for retaining markets. As a result more stabilized prices were achieved.

In spite of the shortage of water in many areas, no major shortfall of produce occurred, this being due to greater use of land with adequate underground water supplies. A continuing increase in the processing of fresh fruit and vegetables took place at Umtali and Cashel. Also there was improved transportation of produce by the Road Motor Service vehicles and by rail.

With the 1d. per lb. duty being totally imposed on imports of vegetables from South Africa and more rigidly enforced, a marked drop in importation was effected.

CLIMATIC CONDITIONS

Rains commenced late, were of poor distribution in many areas and ended early. Freak heavy rain storms then followed in May, which, while being beneficial to some crops, brought on late and unusual outbreaks of fungus diseases in vegetable crops.

While only light ground frosts were experienced, a prolonged spell of low night temperatures occurred. Crop growth was thus much reduced and cold season cropping considerably extended. Hail did some damage to a few fruit crops.

FRUIT

Citrus. Citrus crops were smaller, especially oranges, and no marketing difficulties were noted. More fruit was sold direct from the farms to local purchasers.

Considerably increased planting of orange trees took place at Mazoe on the extension of the British South Africa Citrus Estate, for additional production of concentrated juice for export. New plantings by farmers were much reduced and some orders for nursery trees were cancelled.

There was still a tendency to apply excessive quantities of nitrogenous fertilizers to both full-bearing and younger trees which upset fruit quality and delayed bearing. Trace element deficiencies were mainly of zinc and manganese. Correction of these troubles by foliar applications soon put the trees into such improved condition that less expenditure on fertilizer for a season or so was necessary.

Observations on concentric ring blotch infestation of the leaves, due to grey mite damage, indicated that the more serious attacks occurred in autumn. Food control could thus be obtained by spraying the late season flush of growth in March or April.

With a view to testing the export market again, the Rhodesian Fruit Growers Association made up a trial consignment of some 3,000 cases of oranges for the United Kingdom market. Various unforeseen delays were encountered and the fruit had finally to be diverted to another country. Some wastage upset the profitability of the venture but much experience of value was obtained.

Statistical Office returns of citrus trees in Southern Rhodesia for 1958/59 were:

	Trees	*Value of Fruit Sold or Processed*
Orange	323,000	£183,800
Other Citrus	78,000	20,000
TOTAL	401,000	£203,800

Export of concentrated orange juice for 1959 showed a marked increase, being valued at £117,648.

SUB-TROPICAL FRUITS (OTHER)

Bananas. No marked increase in planting of bananas took place. Less than 10 per cent. of the Cavendish variety marketed is locally grown, the balance being imported from Portuguese East Africa.

The bulk of the fruit handled in Salisbury was cured and ripened in a very modern and efficiently run banana factory.

Pawpaws. This crop is grown to a limited extent but mostly for local sales. Some commercial supplies from Shamva and Cashel were marketed in Salisbury but larger and more sustained production is required to make more impact on markets.

In areas of 4,500 feet and over, fruit is more subject to ripe fruit rot (anthracnose), which spoils the flavour. Trees adequately fed and with larger foliage tended to be less affected by the disease.

Avocadoes. With a good supply of grafted trees of suitable varieties, propagated locally, costs of planting are now reduced. Fuerte is still the most favoured variety and is readily marketed. By far the larger quantity of fruit sold is from seedling-grown trees of many different types.

Pineapples. Some reduction of plantings occurred in the Melsetter and Chipinga areas with more interest now being taken in coffee production. It is fair to state that the marketing disappointments which occurred could have been reduced by better producer methods and more organized outlets. The Queen variety is the one mostly grown.

Other Kinds. Moderate new plantings of mangoes were continued. Such fruit if packed in trays, and with improved presentation, can be readily marketed.

There was virtually no commercial interest taken in granadilla growing and fruit supplies were negligable. The price offered by a Salisbury bottling company was £25 per ton.

While the common guava is grown in large quantities in the Eastern districts, only limited use can be made of it by the processing industry. The industry requires fruit of the Van Retief variety, which has a greater thickness of flesh.

Cape gooseberries were being grown to quite an extent in the Eastern Districts as they are much in demand for canning. They fit in quite readily with vegetable growing for rotational cropping.

DECIDUOUS FRUITS

With a most favourable winter of prolonged low minimum temperatures deciduous fruit trees were able to enjoy a complete winter dormancy. This has been of great benefit in considerably reducing delayed dormancy, resulting in early and more luxuriant spring growth.

Even with such favourable environmental conditions, apple trees which received a mid-August application of D.N.O.C. oil spray were still stimulated into even greater growth response.

Of fruit crops, apple yields were higher, peaches fairly good, with plums being a very light crop.

Marketing. With much improved organization and distribution by the Eastern Districts Fruit Pool, wholesale marketing of deciduous fruit was successfully carried out. Fruit quality, grading and packing continued to show improvement.

Inspection of Pool Members' fruit by the Plant Inspectors at the Central Railway Stations was carried out to the general satisfaction.

Import Controls. In response to representation by the fruit industry and with a renewal of the Trade Agreement with South Africa, it was agreed to extend the period of import control of apples from January to March to include April.

To further assist the local deciduous fruit industry, import control in respect of pears, peaches and grapes for a one-month period has been made possible.

Grapes. The considerable interest in grape growing was continued, such stimulation being promoted by popular press articles and visitors from other grape growing countries. More inquiries than ever were received for advice and information on the subject.

Over 100 acres of vines are now established, most of which consist of dessert grapes. Small-scale commercial production of wine at Rusape was continued.

Fruit Tree Plantings. A second annual meeting took place at Umtali between representatives of the fruit growers, the processing industry and officers of this Ministry, to discuss and review plantings in the light of present day fruit requirements.

Deciduous Fruit Tree Statistics. Recorded totals of tree populations in Southern Rhodesia for 1958/59, as supplied by the Central African Statistical Office, are:

Apple	59,000
Peach	47,000
Plum	20,000
Pear	3,000
Apricot	2,000
TOTAL	131,000

Fruit Importation. Federal imports of the various kinds of fruit, for 1959, were:

	Tons (2,000 lb.)	*£*
Deciduous	5,377	309,000
Grapes and miscellaneous	2,191	97,500
Citrus	1,795	16,370
Other sub-tropical	733	26,680
Bananas	3,594	49,350
TOTAL	13,690	£498,900

TEA

Tea planting continued, the recorded area for 1958/59 now established in Southern Rhodesia is 3,120 acres. Of this 2,930 acres are in production. A total of 2,084,700 lb. of tea was produced, the average yield being 711 lb. per acre.

The more recent plantings in the low altitude area of Inyanga have now come into commercial production.

COFFEE

Coffee planting has gone ahead in the Chipinga and Melsetter districts. Recorded acreages in Southern Rhodesia for 1958/59 are given as 12 in bearing and 140 non-bearing. More extended plantings have since been made and additional seed-beds sown.

Provided the crops are well handled and correctly treated, the local market demand is good.

VEGETABLES

Vegetable production continued to increase, larger acreages being utilized for supply to the Cashel and Umtali processing factories. The recorded total acreage for Southern Rhodesia for 1958/59 was 5,300 being 300 more than the corrected total given the previous year.

It was quite a favourable year for cropping, the rains being interspersed with sunny spells which kept fungus diseases under control. The freak rains that fell well after the end of the rainy season proper brought on later outbreaks of cabbage "Black Rot" and "Late Blight" in potatoes and tomatoes than has previously occurred. Peas also suffered from fungus diseases.

Better continuity of supply, and no sudden shortfall, greatly facilitated marketing and even-flow distribution. With a once-a-week refrigerated truck put into operation by the railways for Umtali to Bulawayo traffic, this provided a ready means to increase supplies of vegetables to Matabeleland.

Tomato production had built up to such a considerable degree that, most of the year, farmer growers of average quality tomatoes only obtained medium to low prices.

With marked improvement of tomato growing by intensive methods market gardeners on the outskirts of the towns, by the use of English varieties, obtained much enhanced prices throughout the year. Yields too have been quite considerable. Various forms of greenhouses were in use near Salisbury with polythene being the most popular covering for structures.

Fresh Vegetable Imports. Federal imports in 1959 were on a much reduced scale, being 1,827 tons valued at £47,950 as against 2,700 tons and £78,000 the previous year. Much of this decrease can be attributed to the 1d. per lb. duty which was totally imposed from 1st January, 1960.

Bulawayo received the bulk of such imports. While much of it consisted of vegetables of the cucurbit family, quite a quantity were of vegetables in season of which more can and should be produced locally.

Vegetable Exports. These consisted of processed vegetables from the Eastern Districts, which for 1959 gave the following figures:—

Dehydrated	£109,407
Canned	10,470
TOTAL	£119,877

Onions. For 1958/59 the acreage planted was 410, which produced a recorded yield of 23,400 bags (120 lb.) The previous season's crop was insufficient to supply the market beyond mid-January and importation became necessary six weeks ahead of the ending of the import control period.

To give added incentive to early season crop production, when imported onions are at their highest price, permit control was extended to include August. Due to the cold season, crops were delayed and importation had to be permitted until mid-September.

Vegetable Research. Research work on onion and cauliflower nutritional and cropping studies was continued at the Henderson Research Station, Mazoe, in co-operation with the resident Senior Agronomist. Results of the experiments appear in the Henderson Station report.

The work also carried out at this station on pea growing for seed can also be of value and applicable for green pea production.

NURSERIES, PLANTING MATERIAL, CUT FLOWERS

Registered nurseries in Southern Rhodesia for the current year were 60, of which 24 were in the Salisbury area. Local propagation of planting material continued to increase, with higher standards of production, especially of eelworm control. Importations of bulbs, plants, trees and shrubs for the Federation for 1959 were valued at £42,960 (last year £45,000). Similarly, for cut flowers, these totalled £10,473, which was a slight increase.

HORTICULTURAL SERVICES

With the horticultural industry having outstripped the services the Horticultural Branch can provide, and coupled with ever-increasing horticultural work in every direction, it was extremely difficult to cope with the situation. To take on other new commitments was only possible by cutting down on both specialized advisory work in the field and the writing of articles.

Having to deal with horticulture in its widest application demands considerable knowledge and experience. To keep up-to-date with the latest developments and digest the wealth of technical information published today is in itself a major task.

Callers at Head Office for information and requests by letter and telephone were more numerous than ever. It is essential that such services be better maintained without the breaks in continuity and delays that currently occur.

Liaison was well maintained with the Department of Conservation and Extension in various ways and specialized assistance given to officers in the field. Visits were jointly made to various areas but of necessity these were on a reduced scale. Various meetings were attended and horticultural talks and demonstrations were given in several areas.

The Senior Horticulturist gave six lectures, on fruit and vegetable growing and marketing, to senior students at the Gwebi Agricultural College. Two such lectures were also given to officers attending a Department of Conservation and Extension irrigation course.

COMMITTEES

The Senior Horticulturist served on the following committees during the year:

1. Departmental Fruit Imports Advisory Committee.
2. Departmental Show Exhibits Committee.
3. Departmental Potato Technical Committee.
4. Rhodes Inyanga Orchards Advisory Committee.
5. Rhodesian Horticultural and Crops Seeds Association (previously known as the Rhodesia Vegetable and Flower Seeds Growers Association).
6. Salisbury and District Garden Club Committee.
7. Crop Weeds Sub-Committee.
8. Federation National Seed Campaign Committee.

He also continued as official correspondent to the Commonwealth Bureau of Horticulture and Plantations Crops, East Malling, Kent, England.

HORTICULTURAL ARTICLES

A comprehensive article on "Fruit, Flower and Vegetable Exhibiting" was written for the agricultural page of the Rhodesia Herald. Various other horticultural articles were received for attention from officers and outside correspondents prior to publication. Technical information was supplied on request to writers of horticultural cropping articles.

SHOW JUDGING: EXHIBITING

The Senior Horticulturalist judged fruit, vegetables and flowers at agricultural and/or horticultural shows at Bindura, Bulawayo, Gwelo, Highlands, Macheke, Salisbury, Sinoia, Umtali, Umvukwes and Wankie. There were numerous exhibits of high quality at a few shows while at other centres these were poor.

An educational exhibit, the pruning, grafting and care of fruit trees, was staged at the Salisbury Agricultural and Horticultural Show. It proved of much interest to the public.

RHODES INYANGA ORCHARDS

Situated in the higher altitude areas of the Eastern Districts, with cooler climatic conditions, these orchards are run as an experiment station for deciduous fruit production. The station serves an important fruit growing area.

Climatic Conditions

The year was one of the driest experienced, as only 30.11 inches of rain was registered, the annual average for the 1951-59 period being 51.88. Only 2.22 inches fell in January which is usually the wettest month.

Frosts were recorded on 71 nights, being more numerous in May, July and August; the absolute minimum temperature was 16.1 degrees F. Mean temperatures for June and July for the critical dormancy months were 51.5 degrees F., and 47.9 degrees F. respectively. Hail storms were numerous.

Fruit Crop and Sales

Most varieties of apples cropped well as this was the onseason of cropping for apples. Due to a severe hail storm in November much fruit was so blemished and marked as to reduce it to a lower grade. Fruit sales realized just over £1,400 (last year £835). Full support was given to the Eastern Districts Deciduous Fruit Pool who handled and distributed the higher quality grades. More fruit was sold to the canning company at Umtali, for processing.

Some difficulty was experienced in marketing dessert pears of the Bon Cretien variety.

Research Work

With the development of the new area for research purposes, little experimental work was possible in the older orchards, where in any case the programme has been largely discontinued.

The irrigation experiment with the variety Kakamas Cling canning peach was continued and extended to include nitrogen applications, pruning and fruit thinning. Significant results from the irrigated trees were again confirmed.

Cherry tree introductions of the varieties Governor Wood and Black Tartarian commenced to bear fruit.

APPLE STORAGE TRIALS

Three varieties of apples, York Imperial, Commerce and Versfeld were put into coldroom storage in Salisbury for trial. Although the temperature was only maintained between 40 degrees F. and 45 degrees F, the fruit kept successfully for three and four months.

NURSERY

Further apple root-stocks were obtained and set out, as also pear stocks. There was only a limited supply available of the material required. Cuttings of apple stocks were also being tried. More seed was sown.

Nursery stock of a few varieties of raspberries were introduced for trial.

CIDER

Small experimental pressings of different varieties of apples were tried for cider. Rhode Island Greening produced the most pleasing one.

DEVELOPMENT WORK

Work continued on the new orchard area. Some ploughing and levelling was carried out. The local Soil Conservation Officer made a contour survey plan and the Chemistry Branch mapped the soils.

A survey of the irrigation furrow was made prior to work being put in hand to improve the water supply. Larger asbestos piping was installed for additional irrigation needs.

Various building work was carried out using local stone.

SEED POTATO GROWING

On behalf of the Potato Officer, an area of exposed high-altitude land was opened up to grow and maintain stock of disease free varieties of potatoes.

GENERAL

Some staff changes occurred during the year. The Orchard Manager resigned and a new appointment was made. The Horticulturist was appointed Officer-in-Charge.

An increased number of advisory visits were possible and advice was also given direct to callers at the station.

Grafting wood of a dozen varieties of apples was supplied to two commercial fruit growers for propagation work.

PASTURE RESEARCH

DR. OLIVER WEST, *Chief Pasture Research Officer*

The year under review is marked by several entirely unconnected events, all of great importance to pasture research.

These events include:

(1) The drought in Matabeleland.
(2) The publication of the Interim Report on Milk Production Costs.
(3) The meeting of SARCCUS in Nyasaland.

They will be dealt with under appropriate headings in this report.

THE DROUGHT IN MATABELELAND

A severe drought in the south-west and along the western border of Matabeleland has resulted in heavy livestock losses. This is the first real drought the Colony has experienced for a number of years and it is unfortunate that its effect was aggravated on many farms and ranches by *overstocking and bad management.*

The common and widespread reaction to the good years which followed the droughts of 1947 and 1948 was to take advantage of the rains and to stock to the limit. This prevented any real recovery of the grass and encouraged thickening and encroachment of bush. If safe stocking rates, well within the carrying capacity of the veld, had been maintained during the years of plenty and the excess grass used effectively in combatting bush by controlled burning, the condition of the veld and its ability to resist drought would have improved tremendously.

This is borne out in the isolated instances where veld was well managed. Here the effect of the drought was not nearly so disastrous and cattle losses were reduced to the minimum.

In this lies the most important lesson that can be learned from the drought—the importance of proper veld management and the need to inquire why the good work carried out on the research stations in the ecology and management of veld has produced so little effect over the country as a whole.

THE COST OF MILK PRODUCTION

A study of the recent report on the cost of milk production reveals that in Southern Rhodesia milk produced from irrigated pastures costs more than milk produced from conventional feeds.

This is a very disturbing conclusion from which, unfortunately, no relief is provided by a study of the use made of the dryland pastures for milk production.

The conclusion that in this country nearly all of the milk produced for sale comes from concentrate feeds is inescapable, while grazing, be it from irrigated pastures, dryland pastures or veld is hardly ever asked to provide more than maintenance.

The effect of this attitude on the cost structure of the dairy industry should not be underestimated. Results obtained on the research stations show quite conclusively that highly productive, milk producing pastures can be grown under irrigation and in the higher rainfall areas on dryland and that properly used these pastures can produce milk more cheaply than can concentrate feeds.

From 17 acres of irrigated pasture at Grasslands high producing Friesland cows yielded in slightly less than a year (10/9/56 - 6/9/57) 1,316.5 (3.8 per cent.) gallons of milk *per acre* from grass without concentrates. Concentrate supplementation at 3 lb. per gallon for every gallon in excess of four, resulted in an additional 217.6 gallons *per acre* grazed or a total milk production per acre of 1,534.1 gallons. Considered in terms of lb. of fat per acre the yield without concentrates was 500.27 lb. of butterfat per acre and with concentrates at 3 lb. per gallon of milk for every gallon in excess of four, 582.96 lb. of butterfat per acre. These are enormous yields by any standard.

Yields under dryland conditions in Southern Rhodesia must necessarily be much lower because of the limitation imposed on the length of the season of production by the pattern of rainfall distribution.

But at Grasslands where for a number of years the Friesland dairy herd was used in evaluating the productivity of fertilized dryland pastures, it was found that for approximately 3½ - 4½ months in each year pastures were capable of supplying all of the nutrients required for maintenance plus three gallons of milk. The highest production measured from dryland summer pastures was 516 gallons (3.5 per cent.) per acre from grass without concentrates in part of block 5 in 1952. This was attained at a cost of £10 per acre for fertilizers whereas the cost of bought concentrates for the production of 516 gallons of milk would have been about £20. A clear advantage in favour of milk from grass.

In a country where the high cost of production and consequent high selling price have led to an embarrassing surplus of fresh milk because the bulk of the population cannot afford to buy milk and where large quantities of milk products are imported each year from other countries at prices with which the local industry cannot compete, any hope of reducing current production costs should be eagerly seized. Why then is so little made of the potential of pastures for milk production?

THE NEED FOR SPECIALIST ADVISORY OFFICERS IN VELD AND PASTURE MANAGEMENT

Research officers have made great progress in their investigations of the *ecology and management* of veld. They have established principles, which if correctly applied in systems of management designed to suit the circumstances of particular farms or ranches, can be used to maintain the veld in a stable or improving condition.

On the pasture side their success is just as encouraging. Suitable pasture species have been selected, developed and made available to farmers, methods of pasture establishment have been devised and the techniques of fertilization, management and utilization established. The value of these pastures in reducing erosion, shortening the tobacco rotation, reducing disease and improving the crop has been established, and their productive capacity amply demonstrated.

It is discouraging that this work, the excellence of which cannot be doubted, has produced so litte effect on the economy of our agriculture.

On the veld management side there is an almost universal lack of appreciation of the importance of veld management and of the consequences which follow neglect of its application.

On the pasture side while the value of pastures for conservation purposes and in the tobacco rotation are widely appreciated, there is a surprising dearth of knowledge among farmers of how pasture should be established, fertilized and managed and very little appreciation of the difference between good and poor pasture.

The productive capacity of pastures is hardly appreciated and considering milk production very few farmers ask for more than maintenance from established grass.

Veld management and the utilization of established pastures are new to Rhodesian farming, and are not part of the farming practice which has become traditional here. New and complicated techniques, fresh lines of thought are involved. It is not surprising therefore that taken by and large the work of this Branch has produced very disappointing reaction over the country as a whole.

It is essential that the knowledge of veld and pasture management should be taken from the research stations to the people responsible for managing veld and for growing pastures, but at present no means exist for getting this knowledge across.

The *research staff* do what they can but this amounts to very little, because they are not organized or trained for the work of extension and have little time to devote to it.

The *Conservation and Extension Service* endeavour to bridge the gap but they too are unsuccessful, because they lack the specialized knowledge and experience for the giving of expert advice in these subjects and because they too have a multiplicity of duties and are unable to devote much time to veld and pasture management.

The answer undoubtedly lies in the provision of *Specialist Advisory Officers* in *Veld Management and in Pastures.*

To keep in touch with their subjects and abreast of developments it is essential that these officers should be kept in very close touch with the work of this branch.

SARCCUS

The Seventh Meeting of the *Southern African Regional Committee for the Conservation and Utilization of the Soil* was held in Nyasaland in April and May.

Some of the recommendations and resolutions which emanated from this meeting call directly for action from the pasture research angle.

(1) BUSH CONTROL. Recommendation II.—Pastures and Water Supplies (Minutes item 4 (a) (3)).

A sub-committee of one member, Dr. O. West, has been appointed to investigate the problems concerned with Bush and Bush Control in the territories of the various member governments and to report back to SARCCUS at the next meeting in 1962.

This is a formidable but very important task, which ties in closely with the work of the departmental sub-committee on Bush and Bush Control in Southern Rhodesia of which the Chief Pasture Research Officer is chairman.

(2) VEGETATION SURVEYS AND A STUDY OF SUCCESSFUL CHANGES IN PROTECTION BLOCKS. Resolution I (a) (Minutes item 4).

Some protection blocks for the study of successional changes have been established at Grasslands, Melsetter and at Matopos. More are required in other vegetation types and it is hoped that it will be possible to establish some of these during the coming year. It has not been possible as yet to devote any attention to a study of successional changes or to the vegetation surveys that should form part of these studies.

(3) COLLECTION OF PASTURE SPECIES. Resolution I (b) (Minutes item 4).

> "Because of the great wealth of grasses and legumes in the flora of Southern Africa and the potential of these plants in agriculture, SARCCUS urges member governments to collect promising species for screening in nurseries and to facilitate the interchange of this material between countries."

This work has always been the personal responsibility of the Chief Pasture Research Officer and has, because of the absence of any staff specifically devoted to it, been conducted on a part-time basis with whatever assistance that could be obtained on a voluntary basis from pasture research officers engaged in other duties.

The nursery has in the past yielded most valuable results but if real progress is to be made at this stage it is highly desirable that the introduction nurseries should become the full-time responsibility of a Pasture Plant Introduction Officer whose duties would include the systematic screening of material in different environments, the co-ordination of the results obtained and the maintaining of a close liaison with Plant Introduction Officers and departments in other territories.

THE RESEARCH STATIONS

Reports dealing with the activities of pasture research officers on the Grasslands, Matopos and Henderson Research Stations and on the Pasture Sub-stations at Tuli and Nyamandhlovu and at the Gwebi Agricultural College will be found in the appropriate sections.

PASTURE SEEDS

A total of 111,785 lb. of grass seed were produced and sold during the season 1958-59. This is an increase of 14,451 lb. on the figure for the previous year. in actual fact the difference was even larger than this, as there was a carry-over of a considerable quantity of Giant Rhodes Grass seed which was produced but not sold and which will be reflected in the figures for 1959-60. The following tables show the quantities of locally grown grass seeds and imported grass and clover seeds sold by the official agents to the Rhodesia Pasture Seed Growers Association.

1. GRASS SEED PRODUCED AND SOLD IN SOUTHERN RHODESIA IN THE SEASON 1958/59

	Certified seed including Foundation and Mother lb.	*Uncertified seed* lb.	TOTALS lb.
Katambora Rhodes Grass	33,968	21,863	55,831
Giant Rhodes Grass	29,520	—	29,520
Love Grass, Ermilo Strain	3,005	22,666	25,671
Sabi Panicum	461	—	461
Bambatsi Panicum	—	262	262
Green Panic	40	—	40
TOTALS	66,994	44,791	111,785

2. IMPORTED GRASS SEED SOLD IN SOUTHERN RHODESIA IN THE SEASON 1958/59

	lb.
Paspalum dilatatum	3,180
Paspalum Urvillii	200
Teff	7,600
Cocksfoot S.143	1,683
Fescue Alta and K 31	1,365
Bromus Catharticus and Marginatus	507
H. I. Ryegrass	3,899
Italian Ryegrass	9,097
TOTAL	27,531

3. IMPORTED CLOVER SEED SOLD IN SOUTHERN RHODESIA IN THE SEASON 1958/59

	lb.
Crimson	44
Chilean Red	1,085
Alta Swede Red	293
Montgomery Red	80
Sweet Clover	40
New Zealand White	816
S.100 White	191
Trifolium Semipilosum	66
Trifolium Roupelliam	90
TOTAL	2,705

ECOLOGICAL AND LAND-USE SURVEYS: VISITS TO STATIONS

During the year ecological surveys were carried out in the *Tea Growing areas of Nyasaland and Southern Rhodesia* for the *Tea Research Association of Rhodesia and Nyasaland,* and in the Chiredzi-Sabi Area for *Tsetse Control.*

Close liaison has been maintained with the National Parks and with the Southern Rhodesia Department of Wild Life Conservation and a visit was paid to the Game Ranches Project on Doddieburn. Other duties made it impossible to undertake surveys asked for by these departments but is hoped that it will be possible to render them some assistance during the coming year.

Assistance to officers of the Department of Conservation and Extension in studying the ecology of their areas has been continued and tours were made in the following intensive conservation areas: Angwa South, Rusape North, Fort Victoria and Umvuma.

Regular visits were paid to all of the research stations and the experimental farms at Karoi and at Chipinga were visited during the year.

COMMITTEES, CONFERENCES AND MEETINGS

The Chief Pasture Research Officer serves on sixteen Government committees. During the year he attended and spoke at a number of farmers and intensive conservation area meetings, field days and courses for Conservation Officers. He attended the Eastern Regional Conference of the Department of Conservation and Extension. The Seventh meeting of the Southern African Regional Conference for the Conservation and Utilization of the Soil in Nyasaland and the Eighth International Grasslands Conference in Great Britain, at which conference he served as chairman of the section on tropical grasses.

He judged pasture competitions in the Beatrice (11.4.60) and Marandellas South (16 - 18.5.60) intensive conservation areas.

He delivered papers at the Intensive Conservation Area Conference in Lusaka.

MEETING OF PASTURE RESEARCH OFFICERS

A meeting of the entire Pasture Research staff was held at Matopos in May.

THE MELSETTER PASTURE STATION

STAFF

Because of promotions, transfers and accident, the full-time staff of two on the Melsetter Station was changed several times during the year.

Mr. L. W. T. de Kock, the Technical Assistant was transferred in March, 1960, on promotion to Grasslands Research Station. His place was taken by Mr. F. D. Elias, who was gored by a bull soon after his arrival. His departure to hospital necessitated Mr. de Kock's temporary return to Melsetter. Finally Mr. Elias left for Great Britain on long leave and was replaced for the rest of the year by Mr. J. S. Steyn.

In June Mr. D. Clark transferred to the Department of Native Agriculture and was replaced as Officer-in-Charge by Mr. F. J. B. Atkinson.

THE WEATHER

A very dry January seriously depressed pasture growth at the beginning of the season. The rest of the season was good and there was sufficient rain during the dry season to maintain a strong stand of clover. The total for the 12 months under review was 38.8 inches.

THE DAIRY HERD

The decision to concentrate on the production of milk from grass without concentrate supplementation during the season of the year when grass is productive, began to be implemented in November and December when 12 cows calved and were able to go straight on to fresh grass. The rest of the herd was still out of step, but will be brought into the seasonal programme as rapidly as possible.

Despite very good growth and abundant grazing over most of the season, production from the Jersey herd was not impressive and it has been decided to add a few Frieslands from the Grasslands herd to the Melsetter herd in order to compare their ability to produce milk from high quality pasture grazing with that of the existing Jersey herd. Twelve cows and heifers were sold during the dry season to maintain the herd strength at 20 cows in milk.

SHEEP

The policy of breeding up to a German Merino flock for spring lambing on irrigated pastures in October is being continued. The average weaning weight of 72 lb. in February, 1960, shows an improvement on the 65½ lb. of the previous year.

The flock did extremely well on dryland Kikuyu and Paspalum/clover pastures during the dry season and are showing that there is a very real place for dual purpose mutton and wool sheep in the Eastern Districts. The aim is to increase the Melsetter flock as rapidly as possible by breeding, to the capacity of the existing acreage of pasture. The flock is carefully recorded and ewes are culled on their milk producing ability as measured by lamb weight at 12 weeks and a careful eye is being kept on the situation with regard to worms. In this aspect we are receiving valuable assistance from the Veterinary Department.

PASTURES

The season marked a change in the accepted policy of the Station with regard to the use of nitrogen on grass/clover pastures and with the exception of one first-class pasture, D.9, which has remained productive without nitrogen for a number of years and which has been chosen as a measuring stick of the level of productivity attainable in the absence of nitrogen fertilizer, it has been decided to use nitrogen to increase production where necessary, whether the pasture contains clover or not. By means of parallel fertilizer experiments combined with yield measurements an attempt will be made to measure the effect of nitrogen and other fertilizer on productivity and on the grass/clover relationship in pastures of different ages from renovation to renovation.

The effect of nitrogenous fertilizing was most marked. It led to a great increase in the amount of grass for grazing and silage. More silage was made than ever before and this was of very good quality with a crude protein percentage on the dry matter basis as high as 14.5 per cent.

Kenya Clovers. A very excellent pasture resulted from a seeding of Katambora Rhodes Grass with two Kenya clovers, *Trifolium Roupellianum* and *Trifolium semipilosum.* This was in grand condition with the clover standing 18 in. to 24 in. tall for the Farmers' Day held on 23rd March. It excited much attention and has led to considerable interest in these clovers throughout the Eastern Districts.

Fertilizer Trials on Grass Clover Pastures. Two fertilizer experiments involving nitrogen, phosphate, potash and lime were put down on Kikuyu/clover pastures. While there was no significant response to phosphate, potash or to lime, the response to nitrogen was marked at all levels.

A very serious practical difficulty was encountered in carrying out these experiments which largely invalidates the results obtained. There is no laboratory on the station and no facilities for drying yield cuts. It was found that continuous wet weather at yielding time made the obtaining of air-dried weights impossible. So the results had to be calculated on green weights which are obviously unsatisfactory. The nitrogen response however was so great that it is not in doubt.

OTHER EXPERIMENTS

Other experimental work included a trial of pigeon pea varieties, a fertilizer experiment on white clover, and a trial of lucerne varieties as well as field scale investigation of various techniques for overcoming some of the difficulties experienced in establishing *Paspalum dilatatum* after a potato crop.

Potato trials were carried out for Plant Pathology and stream-flow was gauged for the Irrigation Department. A striking result in the clover fertilizer trial was the very marked response to phosphate and the failure of any seedlings to survive in plots which did not receive phosphate. Lime in the presence of phosphate appeared to produce a beneficial effect.

SOIL SURVEY

The field work of a detailed *soil survey* of the station has been completed by the Chemistry Branch and the report will be available soon.

As a complete record exists of all fertilizer applications and crops, etc., grown on the various fields, the survey is to be followed by sampling and soil analyses so that the present condition of the soil can be correlated with past practice and a rational basis arrived at for future applications of fertilizer.

HORTICULTURE

During the year Mr. Jones, the Horticulturist seconded to Conservation and Extension, has been quartered on the station and has begun work on a horticultural programme which will be continued and it is hoped expanded.

Coffee. An old coffee plantation established many years ago on the Martin Forest Reserve has been entrusted to the Station and is being brought back into production. It is thought that the material contained in this plantation may be very useful in the developing coffee growing industry of the Eastern Districts.

VISITS

The visits of the Officer-in-Charge to local farmers was considerably curtailed this year due to lack of mileage. The Officer-in-charge however remained a co-opted member of the Melsetter Intensive Conservation Area Committee, and attended their field days.

FARMERS' DAY AND VISITORS

A very successful field day was held on the station on the 23rd March, 1960, in collaboration with the local Intensive Conservation Area Committee. Approximately 50 people attended. The number of visitors during the year numbered over 200.

LIAISON COMMITTEE

Two meetings of the Liaison Committee were held during the year on 1st June, 1960, and on 27th October, 1960. These meetings have been found to be of great assistance to the station and the members of the committee are to be congratulated on the trouble they have taken to attend meetings, many travelling great distances to do so. The advice and assisance provided by the farmer members has been of the greatest help and is much appreciated by the station.

ACKNOWLEDGEMENTS

I am happy to acknowledge the full and helpful co-operation I have enjoyed during the year with my colleagues and the staff of the research stations and the Gwebi College.

AGRICULTURAL EXPERIMENT STATION, SALISBURY

A. G. H. RATTRAY, *Officer-in-Charge*

SEASON

The season was an unfavourable one for high yields as the rainfall during the growing season was nearly ten inches below normal. A good soaking rain of almost two inches fell on November 18th and the planting of maize, potato and velvet bean trials was started but soon had to be discontinued as no more rain fell for three weeks. Satisfactory rains fell during the remainder of December but the rest of the season was abnormally dry, particularly January and March. Under the circumstances maize yieds, except in the late planted trials, were satisfactory; some of the other crops such as soya beans were affected by the unfavourable rainfall to a greater extent.

The amount of leaf blight *(Helminthosporium turcicum)* on maize was never severe but a little more than might have been anticipated in such a dry season. Some varieties of wheat were severely attacked in the 1959 winter by a virus causing stunting and reduced yield. The symptoms corresponded with those recorded when maize streak, Zea Virus 2 Smith, attacks wheat and it was feared that an increasing amount of streak would occur in the summer maize crop. However, only a few isolated maize plants showed streak symptoms and the 1960 winter wheat crop was relatively free. After the severe attacks of late blight, *Phytophthora infestans,* in recent years on summer potatoes, the 1959/60 crop was relatively free. What blight did occur was very patchy and irregular and made the comparison of material for blight resistance impossible.

CROP ROTATION TRIALS

The maize plots in these trials were planted in November and yields were in most cases up to normal. In a number of cases fertilizer is applied in alternate years and, this being the season in which they receive their biennial application, yields were in consequence above normal, an indication that in many of these crop rotation systems the limiting factor is plant nutrient rather than rainfall. It has been decided that, at the conclusion of the 1960-61 season, the cropping systems in these trials, and more particularly the fertilizer practice, will be reviewed. Although in many instances the applications of phosphates being given at present may be adequate there is no doubt that the crops are suffering from a shortage of nitrogen and probably potash.

In spite of the unfavourably dry season, the falling yield trend observed in the new systems S to Y, started in 1954, was halted. Yield figures for the six seasons are tabulated.

YIELDS OF MAIZE (in bags of 200 lb. per acre)

Season	S1	S2	* T1	*T2	W	*X	*Y	H
1954/55 .	26·05	28·43	23·78	24·90	25·54	22·51	21·08	20·19
1955/56 .	20·60	22·75	19·55	20·20	G.M.	G.M.	G.M.	15·80
1956/57 .	15·85	20·30	16·00	17·60	22·00	21·75	20·53	18·85
1957/58 .	10·10	10·70	13·95	15·40	16·13	17·15	16·68	16·65
1958/59 .	15·75	17·80	17·28	19·73	G.M.	G.M.	18·47	16·32
1959/60 .	18·25	19·00	22·48	21·78	23·15	23·80	19·94	17·48

* Stover ploughed back.

S1 and T1 = Maize annually. 50 lb. N per acre per annum, half applied at planting and half as a top-dressing 6 weeks after planting.

S2 and T2 = Maize annually. 100 lb. N per acre per annum, half applied at planting and half as a top-dressing six weeks after planting.

W = Green manure followed by two crops of maize. 100 lb. N per acre applied as a top-dressing, six weeks after planting, to the second crop of maize.

X = Green manure followed by two crops of maize. 50 lb. N per acre ploughed in with the stover of the first maize crop and 50 lb. N per acre applied as a top-dressing, six weeks after planting, to the second maize crop.

Y = Green manure followed by four crops of maize. 50 lb. N per acre ploughed in with the stover of the first, second and third maize crops and 50 lb. N per acre applied as a top-dressing, six weeks after planting, to the second, third and fourth maize crops.

Adequate dressings of phosphates and potash are applied every year to all the above systems.

H = Velvet beans for green manure and maize in alternate seasons. Adequate dressings of phosphates applied to the maize.

The system H has been in progress since 1919 and the lower yields from this system may be due to potash deficiency or to the use of velvet beans, and no other legume, whenever the plots are down to green manure. It has been noticeable that velvet beans grow less vigorously in this system than in other parts of the station where a wide rotation is practised and potash applied when necessary.

It is interesting that the 1959-60 yields from systems W and X, where maize immediately follows a green manure, are higher than those from any of the other systems although no nitrogen was applied in that year to systems W and X. The beneficial effect of ploughing the maize stover back appears to be greater in the maize continuous systems, S and T, than in the system X, where a rotational green manure crop is introduced.

STUBBLE MULCHING AND TRASH FARMING

The object of this investigation is to compare methods of using maize stover and other crop residues on the farm, particularly with regard to the effect of these methods on yield. Maize was the crop grown in the 1959-60 season. As it followed soya beans, the weight of the residues ploughed back or left on the surface as a stubble mulch was considerably less than would have been the case if it had followed maize.

Crop Residue Treatments

A = Control. All residues removed.
B = Residues ploughed back (trash farming).
C = Residues left on the surface as a stubble mulch.
D = Residues removed and a dressing of two tons of kraal compost per acre ploughed back.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

Season	A	B	C	D	Mean
1954/55	20·36	21·03	18·86	22·79	20·76
1955/56	19·93	21·68	20·51	22·12	21·06
1956/57	29·40	31·29	27·07	31·10	29·71
1957/58	18·20	19·48	15·85	19·39	18·23
1958/59 (Soyas)	6·72	7·83	7·87	7·41	7·46
1959/60	16·64	16·27	18·80	17·20	17·23
MEAN (Maize)	20·91	21·95	20·22	22·52	

1959-60 is the first season in which the maize yields from the stubble mulch plots have compared favourably with those from the other treatments. Although this may be due to the beneficial effect of a surface mulch in retaining soil moisture in a dry season, the amount of residue material left over from the 1958-59 soya bean crop was small and is unlikely to have had the same effect as the residue from a well-grown maize crop. The mean yields of the five maize crops since this trial was started in 1954 shows that there is little difference between treatment B, in which the stalks are ploughed back, and treatment D, where they are removed and a compensating amount of animal manure returned to the land.

MAIZE

BREEDING

It is becoming more and more apparent that those hybrids which give the highest yields in trials at Salisbury, although they may prove the best of the available material in some parts of the country, are often outyielded in other areas by hybrids which at Salisbury are comparatively disappointing. Trials are conducted each season in all the more important maize-growing areas of both Northern and Southern Rhodesia, but the number of varieties in each trial has to be strictly limited, particularly when the trials are carried out on private farms under the supervision of officers of the Department of Extension Services. The results from all these trials are tabulated in the station's report and show that the mean yields from S.R. Hybrids 10, 11 and 12 were 22.37, 22.20 and 25.07 bags per acre compared with 15.19 and 18.64 bags per acre from Hickory King and Southern Cross.

The general mean of the three hybrids is 23.21 bags per acre and of the two open-pollinated varieties 16.92 bags per acre, a difference of 6.29 bags per acre or 37 per cent. in favour of the hybrids. The magnitude of this difference can be attributed to the unfavourable rainfall which many areas in the two territories experienced. S.R.12 was grown on a wide scale for the first time and, in spite of a season which could be expected to favour quicker maturing varieties, gave considerably higher yields than either S.R.10 or S.R.11 in many areas.

The single hybrid, 58H3, the quickest maturing of all the hybrids tested in these trials, was grown only in the Salisbury and Sabi trials and the results from it are most interesting. For the second season in succession it was most disappointing at Salisbury and yet at the Sabi, planted early in November and given supplementary irrigation, it easily surpassed slower maturing varieties such as S.R.12 which should have benefited most from the early date of planting and lack of water stress. This is a notable example of a variety which, on Salisbury results, would be discarded and yet may prove very useful in other areas. It gave good results in 1958-59 at Matopos.

Population × Fertility Trial

The main object of the trial is to compare the yield of grain obtained at four population rates and to see the effect of soil fertility on the population rates. The fertility level is regulated by the amount of nitrogen applied.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

Nitrogen	(A) 3′ × 18″	(B) 3′ × 15″	(C) 3′ × 12″	(D) 3′ × 9″	Mean
Nil	23·20 **(25·45)**	23·26 **(27·65)**	24·57 **(30·27)**	24·30 **(28·72)**	23·82 **(28·02)**
50 lb. N . .	22·63 **(26·96)**	22·95 **(29·23)**	23·64 **(30·86)**	24·57 **(32·74)**	23·44 **(29·94)**
100 lb. N . .	23·96 **(27·27)**	23·38 **(30·32)**	23·74 **(31·91)**	24·24 **(31·24)**	23·82 **(30·19)**
MEAN . .	23·25 **(26·56)**	23·18 **(29·07)**	23·97 **(31·01)**	24·36 **(30·90)**	

The figures in brackets are the means for the four seasons from 1956/57 to 1959/60. Yield differences in 1959/60 were not large enough to be significant. Results over the four seasons indicate that the optimum population is probably about 14,000-15,000 plants per acre when a moderately vigorous variety such as 51H37 is grown and the plants are spaced in rows 3 feet apart. It has been assumed that high plant populations, whilst they may give better results in favourable seasons, might give reduced yields in dry years when at certain stages the crop suffers from lack of moisture. It is interesting to see that no such reduction has occurred in the season under review, dry though it was, and that within the range from 10,000 to 20,000 plants per acre changes in the population rate have had no material effect.

The variety 51H37 used in this trial is of medium maturity and, as mentioned above, is moderately vigorous. It is reasonable to assume that a tall vigorous hybrid and a short early maturing hybrid may react differently to changes in population levels, and an additional project has been started to investigate this matter as well as the effect of date of planting of hybrids of different habit.

Applications of Nitrogenous Fertilizers

The object of the trial is to measure the response of maize to nitrogen applied in various forms, at planting and as a top-dressing 6 weeks after planting, in bands and broadcast uniformly over the whole inter-row space. The response is measured in grain yields.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

	No N application	33⅓ lb. N	66⅔ lb. N	100 lb. N	Mean
All at planting.		24·21 **(23·81)**	23·06 **(26·58)**	23·27 **(26·86)**	23·49 **(25·75)**
All six weeks after planting		23·49 **(23·02)**	23·79 **(24·54)**	24·05 **(25·87)**	23·78 **(24·48)**
Half at planting half later		24·62 **(23·58)**	22·23 **(25·66)**	24·53 **(27·38)**	23·79 **(25·54)**
MEAN . .	22·07 **(18·78)**	24·11 **(23·47)**	23·03 **(25·59)**	23·95 **(26·70)**	23·69 **(25·25)**
Sulphate of ammonia		24·38 **(23·55)**	22·66 **(26·01)**	23·34 **(26·73)**	23·46 **(25·43)**
Urea . . .		24·52 **(24·21)**	23·47 **(25·57)**	23·86 **(26·15)**	23·95 **(25·31)**
Ammonium Nitrate		23·42 **(22·65)**	22·96 **(25·20)**	24·64 **(27·22)**	23·67 **(25·02)**
MEAN . .	22·07 **(18·78)**	24·11 **(23·47)**	23·03 **(25·59)**	23·95 **(26·70)**	23·69 **(25·25)**

The figures in brackets are the means for the three seasons 1957/58, 1958/59 and 1959/60. As in previous dry seasons when lack of rainfall had a material influence on yields the response to nitrogen was small. The mean yield from all the plots which received their nitrogen as a top-dressing six weeks after planting was slightly higher than the mean yield from the plots which received their nitrogen at planting, a reversal of results from the two previous seasons as indicated by the mean figures in brackets. An interesting feature is the higher yield obtained from the plots receiving no nitrogen (22.07 bags per acre) as compared with 16.09 and 18.18 bags per acre obtained in 1958/59 and 1957/58 respectively. This trial is conducted annually on land which has grown the same crops and received the same application of fertilizer during the two previous seasons. Although the acre blocks into which the land on the station is divided may vary a little in fertility condition the object is to maintain them all at approximately the same fertility level. (This, of course, excludes land under rotation projects.) It is a matter of conjecture to what extent the higher yield this year is due to reduced loss of nitrogen through leaching in a dry season.

Residual Effect of Applications of Nitrogen

The object of the trial is to measure the residual effect of applications of nitrogen to maize the previous season and the trial is conducted on the land used for the main nitrogen trial the year before.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

Nitrogen Level	Time of Application in 1958/59					
	All at Planting		All at 6 Weeks		Half and Half	
	1958/59	1959/60	1958/59	1959/60	1958/59	1959/60
Nil	16·09	14·44	16·09	14·44	16·09	14·44
33⅓ lb. N . . .	22·46	15·78	21·70	17·85	21·61	14·95
66⅔ lb. N . . .	25·91	17·56	23·85	18·08	25·18	18·40
100 lb. N . . .	27·08	18·15	25·31	19·61	27·96	17·45

In contrast to the results from the 1957/58 and 1958/59 trials, the yields this year indicate that a certain amount of the nitrogen applied to the 1958/59 crop remained and was available to the 1959-60 crop. The response to this residual nitrogen was appreciable and must be considered in calculating the value of nitrogen applied if such a residual response is likely to occur at all frequently. As might be expected the response indicates that a bigger proportion of the nitrogen applied to the 1958/59 crop is left over from the top-dressing 6 weeks after planting than from the earlier application at planting.

WHEAT

Both winter and summer crops were grown on the station during the year under review. As forecast last year at the time it was being harvested, the 1959 winter crop gave higher yields than had been obtained previously, probably as a result of improved watering and fertilizing. (Yields from the 1960 crop are likely to be disappointing; the yield trials were conducted on land which had grown an early planted crop of maize in the summer and the Wheat Breeder considers that the physical condition of the soil was far from satisfactory.) The stunting which occurred on such a considerable scale in certain varieties in the 1959 winter crop, and which was attributed to the same virus that causes maize streak, Zea Virus 2 Smith, was almost absent in the 1960 winter crop.

It is becoming increasingly apparent that, although yields from seven to ten bags an acre can be obtained in the summer where weed growth is controlled efficiently, yields in the summer are far short of those attainable in the winter even when the crop remains free from rust damage. The Wheat Breeder attributes this mainly to the high summer temperatures which have the effect of shortening the crop's growing season. In contrast, winter conditions on the highveld are ideal for wheat; a cool growing season followed by a warm, dry period for harvesting. In view of the considerable cost of adequate irrigation for the crop, good or bad, it is considered that the growing of winter wheat will be more profitable if it is conducted at a high fertility level and a variety used capable of high yields under such conditions (Punjab is quite unsatisfactory because it lodges as soon as the fertility level is raised sufficiently for it to produce 12 to 14 bags). Certain varieties developed by the Wheat Breeder are proving capable of high yields and he has released two for bulking and commercial growing.

1. *S29A1.* This is a selection from a cross between Angola X2-50 and White Federation 38, and is in its ninth generation. It is capable of high yields and has the rust resistance typical of the Angola parent. Straw is moderately strong but a little long. It is considered a good filler wheat and has to be mixed with a stronger type. S29"A"1 is well suited to the irrigated highveld and is, at the moment, probably the best of the varieties available for growing in the summer.

2. *F45A7 ("Kafue").* Developed from a cross between the American variety Lee and Selkirk. Although this variety has given considerably lower yields than S29 at Salisbury it has shown itself adapted to conditions on the Kafue Polder. It is highly rust resistant and is a strong baking wheat. Straw is long and tends to lodge under high fertility conditions. The variety is too late for Sabi conditions.

Winter, 1959. For the first time locally produced strains were included in these trials. The following were the most important results.

YIELDS OF GRAIN (in bags of 200 lb. per acre)

Variety	Yield	Variety	Yield
S29A1 (X2–50 Angola x W. Federation).	24·19	F84A9 (Gabo)	16·04*
F255 (Arawa-New Zealand) . . .	18·14	F93 (354P–Kenya)	14·16*
F84A6 (Gabo)	16·86*	Punjab 8A	13·04
F84A5 (Gabo)	16·85*	F45A7 III (Lee x Selkirk) . .	12·82*

Punjab 8A was heavily lodged in this trial.

*These varieties were affected by the virus causing stunting.

POTATOES

As in past years considerable emphasis has been placed on the search for varieties resistant to late blight, *Phytophthora infestans.* Consumer resistance to the tuber characteristics of blight resistant varieties such as Pimpernel and Gineke has created marketing difficulties and increased the urgency of finding blight-resistant varieties with the familiar tuber qualities of Up-to-Date. Consequently the programme has been expanded to include a modest breeding project. Some fifty crosses between commercial varieties and seedlings were made.

The lack of a blight epidemic, due to the abnormally dry season, prevented real progress in the selection of suitable varieties, and most of the new material on hand has had to be retained for, it is hoped, tests for blight resistance in the 1960-61 season.

Seedling Selection. Selection of material provided by the Department of Agriculture for Scotland has continued. A number of seedlings were discarded on growth and tuber characteristics and some forty retained for further trial.

Variety Introduction. These included the Dutch varieties Ari, Minkes E464, and Patrones, a number of varieties supplied by the Northern Ireland Department of Agriculture, the German variety Suzanna, and a number of varieties from Kenya. All are being retained for further trial.

GENERAL

During the year it was decided that Panmure Hybrid Maize Farm should become a sub-station of Salisbury. This development was a natural one as the Salisbury station is responsible not only for the maize breeding programme which has produced the hybrid varieties in commercial use throughout Southern and Northern Rhodesia but also for planning and supervising the production of parent seed of inbred and single hybrid lines required by the Rhodesian Seed Maize Association. Mr. Joyce again spent a week at Panmure assisting the staff of the farm in the issue of this parent seed to members of the Association.

Before the start of the 1959/60 season the Ministry agreed to a proposal from the Seed Maize Association that they should produce a limited quantity of single hybrid seed for sale as well as conventional double hybrid seed. It was appreciated that the much higher price (£10 per pocket of 100 lb. seed) at which this single hybrid seed would be sold would limit the demand and also that its use, instead of double hybrid seed, would only be economic in the higher rainfall areas on the more fertile soils. The two single hybrids, N3-2-3-3 x A5-7-6 and

N3-2-3-3 x SC 5522, which it was decided to produce, both regularly outyield the double hybrids available to farmers at present; but the margin in their favour is naturally smaller when they are grown under conditions unfavourable for high yields. At the time of writing this report seed of these two single hybrids is selling satisfactorily, a number of farmers having decided to grow it on a small scale for comparison with double hybrid seed.

In March the Officer-in-Charge of the station attended the sixth South African Maize Breeders Conference which was held in Pietermaritzburg, Natal. During the conference he presented a progress report on the Salisbury breeding programme. This conference which has been held at irregular intervals provides an invaluable opportunity for all plant breeders working on maize in this part of the World, as well as delegates interested in the production and marketing of hybrid seed, to get together and discuss mutual problems and methods of breeding and producing improved hybrids. The Chairman of the conference pointed out that the most important development in the production of hybrid maize in South Africa had been the decision to allow, and to encourage, private concerns in the breeding and production of hybrid seed. Private breeders were invited to the conference and contributed to the discussions which took place. It was decided that in future these conferences would be held biennially and that the next one would take place at Potchefstroom early in 1962.

The Officer-in-Charge served on the Executive Committee of the Seed Maize Association, the Field Experimentation Committee, the Fertilizer Advisory Committee, the Committee for the Maize and Agricultural Produce Sections of the Rhodesia Agricultural and Horticultural Society, and he acted as Chairman of the Weeds in Crops Sub-committee as well as on the central Weed Control Committee. The Potato Breeder attended meetings of the Rhodesia Seed Potato Association and the Farmers' Co-op Potato Pool in an advisory capacity and he is a member of, and acts as secretary of, the Departmental Potato Committee. He served on the Ministry's Show Committee.

PUBLICATIONS

A. G. H. Rattray:

1. "The Soya Bean in Rhodesia", *Rhodesia Agricultural Journal,* May-June, 1960.
2. "Maize Populations and Spacings", *Rhodesia Agricultural Journal,* May-June, 1960.

O. J. Olesen:

1. "Wheat Production in the Federation", *Rhodesian Farmer,* Vol. XXX, No. 34, December, 1959.
2. "Wheat Production in the Federation", *Rhodesian Farmer,* Vol. XXXI, No. 26, October, 1960.

V. J. Montague:

1. "Potato Production" a bulletin for farmers, *Rhodesia Agricultural Journal,* January-February, 1960.
2. "Potatoes—a Crop Worth Doing Well", *Rhodesia Herald* Agricultural Supplement, August, 1960.

A. G. H. Rattray and N. Fitt:

1. "Maize—What Varieties Shall I Grow?", *Rhodesian Farmer,* Vol. XXX, No. 51, April, 1960.

In addition Mr. Montague prepared two reports:

1. "Some Recent Developments in Potato Research, Production and Handling in the United Kingdom and Holland".
2. "Potato Production in Nyasaland".

GATOOMA RESEARCH STATION

A. H. McKINSTRY, *Officer-in-Charge.*

INTRODUCTION

A Cotton Working Party Committee, appointed by the Minister of Agriculture, to examine and report on different aspects of cotton production, research and marketing, in Southern and Northern Rhodesia, held meetings during the earlier months of 1960.

In regard to potential areas of production in the Rhodesias, it was established that there are large tracts in which climatic conditions are suitable for cotton growing. Minimum annual potential acreages were estimated to be as follows:

Dryland (Southern Rhodesia)	70,000 acres
Dryland (Northern Rhodesia)	80,000 acres
Irrigation Sabi Valley areas, Southern Rhodesia ...	150,000 acres
Other small irrigation schemes, Southern Rhodesia	15,000 acres
TOTAL	315,000 acres

Potential areas where cotton could be grown under irrigation will require heavy capital expenditure for their development. Furthermore, it was estimated that the total production from 315,000 acres could amount to 344,000 bales of lint. To this estimate could be added 175,000 bales as the minimum potential production for Nyasaland.

Thus it is obvious that with the present domestic consumption of between 15,000 to 20,000 bales per annum, the Federation could produce her own domestic requirements and also develop a substantial export trade.

THE 1959-60 RAINFALL SEASON AT GATOOMA

In terms of rainfall amounts and distribution, the 1959-60 season was one of the worst since records were started at the Gatooma Station in 1925-26. Rainfall totals at the three rain gauges, situated at different points in the Station's lands, were 16.99 in., 18.64 in. and 19.28 in. in 1959-60. Similar totals, all below 20 in., which have been recorded in previous seasons, were as follows: 1946-47 (17.16 in.), 1937-38 (19.10 in.), 1930-31 (19.91 in.) and 1927-28 (18.06 in.).

Essential features of the very poor rainfall distribution obtained in 1959-60 were: Very inadequate planting rains in November; of the total 1.47 in. which fell during the month, small showers—over the period 10th to 21st November inclusive —accounted for 1.37 in., the highest fall being 0.35 in. Attempts at establishing cotton plant breeding plots, other experiments, and farm-scale acreages of maize, during November, were a failure. Replanting took place during the second and third weeks of December, for which month 7.83 in. were recorded; but of this total over 5 in. were accounted for in four rainstorms of high intensity. Run-off from storms was high, more particularly, as expected, from lands in fine tilth. A total of 0.52 in., measured in January, 1960, was the lowest on record for this month. By the end of January crops had reached a state of very severe wilt. Finally, although a total of just over four inches of rain fell during the first two weeks of February, low soil moisture conditions were alleviated only temporarily, as there was little further rainfall during the remainder of the season.

Details of monthly rainfall and also sunshine records are given in the following table.

RAINFALL AND SUNSHINE RECORDS FOR THE PERIOD OCTOBER, 1959 TO APRIL, 1960 INCLUSIVE

(Figures in brackets are for 1958/59)

Month	*Total rainfall (inches)*	*Rainless days*	*Longest period without rain*	*Mean sunshine hours per day*
October, 1959	0·52 (3·24)	29	22	10·30 (7·29)
November, 1959 . . .	1·47 (1·49)	16	9	7·61 (7·73)
December, 1959 . . .	7·83 (9·46)	11	4	4·85 (6·06)
January, 1960	0·52 (5·36)	21	6	9·14 (6·79)
February, 1960 . . .	4·62 (3·83)	11	6	6·79 (5·98)
March, 1960	1·29 (0·50)	25	15	9·28 (7·49)
April, 1960	0·91 (0·05)	25	13	7·59 (9·25)
	17·16 (23·93)			

COTTON PLANT BREEDING

Mr. F. E. M. Gillham, Plant Breeder, left Gatooma in the first week of August, 1960, for the University of North Carolina, U.S.A., where he will pursue studies in genetics and biometry, for one year. In consequence, a reduced cotton plant breeding programme is being supervised by the Agronomist, Mr. J. M. Burton.

The following information has been taken from a report prepared by Mr. Gillham prior to his departure for the U.S.A., but before the full results for the 1959-60 season were available. Certain final analyses will be completed on Mr. Gillham's return.

As a result of the severe restriction on plant growth and yield due to drought conditions, no selection work was possible at Gatooma in 1959-60. Therefore, all progenies and model bulks selected in the previous season, 1958-59, will be replanted in 1960-61.

On the other hand, the breeding material grown at Sabi Experiment Station had very favourable conditions for irrigated cotton, and high yields were harvested.

Sabi Replicated Progeny Trial

In this trial comparisons were made between a number of selections from Albar strains, selections from the BMA strains, and G52/36, a U4 variety. Main yield results are shown in the following table.

SABI REPLICATED PROGENY TRIAL, 1959/60

SUMMARY OF MAIN RESULTS

Selection	*Yield: lb. clean lint per acre*	*Parent of the selection*	*Origin*
*S59/169	1,968	S58/76	Albar 637
S59/177	1,868	S58/82	Albar 627
S59/196	1,793	S58/91	Albar 640 × A5851 (BMA)
S59/191	1,788	S58/90	Albar 640 × A5851
*S59/158	1,777	S58/69	Albar 637
S59/183	1,748	S58/85	Albar 637
S59/157	1,693	S58/69	Albar 637
S59/195	1,682	S58/91	Albar 640 × A5851
S59/162	1,665	S58/70	Albar 637
S59/184	1,664	S58/85	Albar 637
S59/186	1,658	S58/87	Albar 637 × A618 (BMA)
*S59/187	1,642	S58/87	Albar 637 × A618
*S59/178	1,642	S58/82	Albar 627
S59/190	1,630	S58/90	Albar 640 × A5851
*S59/182	1,609	S58/85	Albar 637
G52/36	1,396		
Mean of whole trial	1,520		
L.S.D. $P = 0{\cdot}05$	360		
$P = 0{\cdot}01$	473		
C.V.	4·24%		

The five top-yielding strains listed in the table, are significantly superior to G52/36 which is recognized as a prolific heavy yielding U4 strain.

Further selection from this trial was based on a selection index computed from lint per seed, seeds per boll, and lint per plant, the hereditability of these characters being 0.05, 0.61 and 0.44 respectively. A total of 20 strains have been selected, 15 on the basis of the selection index, and five, indicated by * in the table, on the basis of yield alone. Furthermore, up to four progenies will be selected from each strain, while the selected strains themselves will also undergo further trial.

Small Bulk Trials

The seven Small Bulk Trials which were planted with Albar and BMA strains contained, for comparison with each other, a total of 25 strains, namely, 11 1958 selections made at the Sabi Valley Station, 12 1958 selections made at Gatooma, Albar 637 and G52/36.

The trials at Fort Victoria (Central), Gatooma and Lonely Mine, suffered from drought conditions and mean yields in these were of the order of 165, 125 and 80 lb. of clean lint per acre, respectively. In comparison, Small Bulk Trials at "Henderson" (Mazoe Valley), Umtali North, Nyanyadzi, and Sabi Valley Stations, all four of which received irrigation, when required, gave yields of approximately 620, 690, 890 and 1,450 lb. of clean lint per acre respectively.

Two additional Small Bulk Trials, one at Gatooma and the other at Sabi Station, in both of which were planted 24 selections of U4 origin, 12 taken at Gatooma and 12 at Sabi, gave mean yields of approximately 95 lb. and 1,310 lb. of clean lint per acre respectively.

DISTRICT VARIETY TRIALS

Yield results are available from seven centres in Southern Rhodesia at which comparisons were made between six strains, i.e., two Gatooma 1957 selections from Albar, three Gatooma 1957 selections from BMA strains and Albar 637. At three of the centres, namely, Umshandige (Fort Victoria), Henderson Research Station (Mazoe), and Odstock Farm (Umtali North), irrigation water was available when required. Mean yields of the six strains at the three centres, in the order given, were: 364 lb., 537 lb., and 845 lb. of clean lint per acre. In contrast, mean yields of clean lint per acre obtained from the same trial grown at the four remaining centres under dryland conditions, were: Lonely Mine, 51 lb.; Gatooma, 147 lb.; Fort Victoria (Central), 187 lb., and Mount Darwin, 437 lb. In the first three instances the crop suffered very markedly from drought conditions.

Another District Variety Trial comparing two Albar strains, two BMA strains, Albar 637, and G52/36 planted under irrigation at three centres, gave the following mean yields of clean lint per acre: at Sabi Experiment Station 1,336 lb., at Nyanyadzi 739 lb. and at Chirundu Sugar Estates 616 lb.

OBSERVATION PLOTS

In addition to the foregoing results from trials a series of observation plots were planted at Gatooma and Sabi with cotton varieties obtained during 1959 from the U.S.A. and other countries. It is not possible to make a critical assessment of differences between varieties from these plots, but *G. barbadense* strains from the Sudan, *G. arboreum* varieties from India, and Peruvian Tanquis, *G. barbadense,* were all unimpressive and very poor croppers. On the other hand, the very high ginning outturn of a number of varieties from the U.S.A. was impressive and this character will probably be made use of in future hybridization work.

SPINNING TESTS

Seven lint samples from the 1958-59 trials were submitted to the Shirley Institute for small-scale spinning tests. The results are shown in the following table.

RESULTS OF SPINNING TESTS CONDUCTED AT
THE SHIRLEY INSTITUTE ON 1958/59 LINT SAMPLES

Counts spun 40s. (14·8 tex) Twist factor 3·75

Description of Sample	Fibre Tests					Corrected Lea count × Strength of product	Yarn appearance
	Effective Length (1/32″)	Maturity Ratio	Fibre wt. per cm.		Bundle Strength (g/tex) at ⅛″		
			Mean	Standard			
S57/144 Irrigated .	40	0·925	164	177	20·2	2,519	1A
S57/77 Dryland .	41	0·825	173	210	18·5	2,296	1B
S57/91 Dryland .	40	0·83	162	195	18·4	2,184	2B
Albar 637 Irrigated .	39	1·015	200	197	20·7	2,369	1A
G52/36 Irrigated .	40	0·82	186	227	17·1	1,891	2B
Albar Dryland .	38	0·95	209	220	18·0	2,054	1A
G52/36 Dryland .	37	0·755	181	240	17·1	1,780	3B

The report on the tests is as follows:

The "dryland" samples of Albar 637 and G52/36 were somewhat shorter, coarser, and less mature and spun weaker yarns of poorer appearance than the corresponding "irrigated" samples. Both the Albar samples were more mature, finer, and of higher fibre strength than the corresponding samples of G52/36.

Compared with yarn from S57/144 irrigated, which is described as very strong, and very good in appearance, the irrigated sample of Albar 637 was slightly shorter, more mature, appreciably coarser, and of slightly higher fibre strength.

The differences in yarn strength correspond well with the differences in the measured fibre properties.

ALBAR 637 MULTIPLICATIONS

Approximately 10,600 lb. of Albar 637 acid delinted seed was issued to selected growers, for multiplication in 1959-60. About two-thirds of the seed was planted under dryland conditions while the remainder was sown under irrigation, mainly in the Sabi Valley. As a result of multiplication, some 110 tons of ginned seed, derived from Class 1 seed cotton, became available. This quantity of seed proved to be more than sufficient to satisfy the demand by growers, in Southern and Northern Rhodesia, for acid-delinted cotton-seed for planting. Therefore, only Albar 637 has been issued for planting in 1960-61; and this variety now replaces 9L34, the last of the strains descended from U4, in commercial cultivation.

Over a number of years Albar 637 has proved, in trials, to be superior to 9L34 in bacterial blight resistance, and also in yield, lint quality, ginning outturn and boll size. Nevertheless, growers have been advised that the improvement in yield, which is attainable, will not be realised unless cotton crops are well-grown and protected with insecticides from attacks by insect pests.

COTTON INSECT PESTS CONTROL

INTRODUCTION

The following information has been obtained from the Cotton Pests Research Team of Entomologists. In brief, the basic investigations into the biology and control of cotton bollworms together with toxicological studies continue to be carried out at the Gatooma Research Station, Southern Rhodesia, while investigations into the biology and control of cotton stainers continue at the Makanga Experiment Station, Southern Province, Nyasaland.

Associated field trials and biological studies have continued at Chitala Experiment Station, Central Province, Nyasaland, the Sabi Valley Experiment Station, Southern Rhodesia, and in Northern Rhodesia. Unfortunately, the work on cotton stainers has had to be reduced owing to the appointment of Mr. R. C. H. Sweeney to the post of Government Entomologist, Nyasaland. The appointment of two Technical Assistants has helped considerably to broaden the scope of the cotton pest investigations.

GENERAL

A Research Fellowship to study diapause in *Diparopsis*, tenable at the University College of Rhodesia and Nyasaland, has been approved and is scheduled to commence in July, 1961.

The three entomologists of the Cotton Pests Research team each presented papers at the First Federal Science Congress held in Salisbury in May, 1960. These papers have been accepted for publication in the Proceedings of the Congress.

BIOLOGICAL STUDIES

Detailed observations on the behaviour and natural mortality of the various stages in the life cycle of *Diparopsis castanea* (red bollworm) were again carried out.

Eggs. In contrast to the previous season when the proportion of eggs lost remained high throughout the season, egg loss in 1959-60 never exceeded 70 per cent. The reduction in egg loss was due to the relative absence of ants, there being only 1 per cent. of the eggs lost due to this cause in April/May, 1960. A further 19 per cent. was lost through rain and 25 per cent. through no obvious cause.

Larvae. The time of egg hatch and the period and nature of larval wandering before penetration of a fruiting point was achieved, was similar to that shown by the previous season's observations. Larval mortality over this period of the life cycle for eggs hatching February/April was 21 to 26 per cent., most of which was accounted for by larvae ceasing movement and dying without apparent cause. Mortality over the whole larval period was, as with the eggs, much lower, and was largely due to lack of predaceous ants. The only important predators were Hemipterous bugs including the Pentatomid *Agonoscelis versicolor* Fabr.

All major larval movements as well as moth emergences took place during the hours of darkness.

The mean larval period was considerably shorter than for the previous season, and it is thought that this was caused by differences in available food and climatic conditions.

Pupae. The emergence of moths from overwintering pupae under pupation garden conditions extended from December, 1959, to March, 1960, with a distinct peak in January and a smaller peak in February. Under bare-fallow conditions in the field, moth emergences extended from September to the end of March with two peaks (in January/February and February/March). The pattern of moth emergence was similar in cultivated land, but owing to the poor rains, the growth of maize around the cages was poor, and the crop gave less shade than would be the case normally.

Pupal development under laboratory conditions was suppressed at a temperature of 55°F., and continued to be suppressed after the pupae were transferred to 65°F., whereas pupae transferred from 55°F. to 75°F. recommenced development normally.

Overwintering pupae collected in 1958-59 and set in the pupation garden at depths from ½ in. to 8 in. subsequently gave rise to an emergence pattern similar to that obtained in the previous season. The experiment was extended on a small field scale and confirmation was obtained in that from the pupae set at 0-4 in. only 36 per cent. of the moths had emerged by the end of December, 1959, in contrast to an 84 per cent. emergence of the moths from pupae set between 4 in. and 8 in.

It is considered that the mechanical inversion of the soil which would bury pupae to the required depth offers a possible means of control through reducing the effective portion of the carry-over moth flight of *Diparopsis*. It might also allow a reduction in the weekly spraying schedule at present being recommended. This control measure, however, would only be possible on land having a sufficient depth of top soil. A large-scale experiment is in progress to test the effects of inverting the soil on moth emergence.

Heliothis armigera Hbn.

Preliminary observations similar to those made on the behaviour and natural mortality of *Diparopsis* were also carried out on *Heliothis* in March, 1960. In contrast to *Diparopsis*, larval movements of *Heliothis* were more frequent and occurred mainly during the day. Predacious bugs, ants and spiders, and cannibalism were recorded.

CHEMICAL CONTROL

(a) *Toxicity Tests.* The behaviour and mortality of *Diparopsis* first instar larvae from the time of egg hatching was assessed by continuous observation of potted plants in the laboratory. The plants were sprayed to "run off", with different insecticides, and eggs were placed on the upper surface of the leaf, on the stem, or on a bract of a bud. Eggs hatched between 0400 and 0900 hours, and the larvae were observed continually until they had died or penetrated a bud. Observations showed that the wandering-period before death on plants sprayed with Sevin was less than either DDT or Endrin, at comparable concentrations.

The mortality of adult *Diparopsis* moths caged over plants sprayed with Seven, DDT and Endrin indicated that Endrin was more toxic than Sevin and that DDT appeared to have little or no effect on the moths at comparable concentrations.

Toxicity tests with *Heliothis* continue to show that DDT is more toxic than Sevin.

Preliminary tests with *Dysdercus* adults indicate that *D. intermedius* is less susceptible to Sevin than *D. fasciatus* and that Sevin is more toxic to *D. intermedius than* DDT.

(b) *Spray Coverage.* A limiting factor in the use of low volume insecticide sprays (10-20 gallons per acre) for the control of cotton insect pests, particularly *Diparopsis,* is the difficulty of achieving an adequate spray coverage of the plant. Various experiments with different types of nozzles and nozzle placements were carried out, with a view to obtaining better spray coverage with conventional types of sprayer, particularly knapsack sprayers.

A modification, consisting of a "drop arm" or "tailboom", constructed of aluminium, on which six spray nozzles may be positioned to give any desired direction of spray, was designed to fit on to the back of a knapsack sprayer.

The modified knapsack sprayer gave better coverage in dense cotton when compared with a high clearance mechanized tractor sprayer and a helicopter sprayer.

(c) *Field Trials.* Although yields in the field trials at Gatooma were generally low, the entomological data showed that Sevin gave the best control of *Diparopsis* larvae, and that the overwintering pupal population was also greatly reduced. Under conditions of very severe drought treatments involving Sevin as a spray gave yields of approximately 400 lb. per acre seed-cotton compared with 300 lb. seed-cotton per acre from Endrin. Unsprayed bulk cotton yielded at the rate of under 50 lb. of seed-cotton per acre.

In a time-of-application trial, using Endrin, it was again confirmed that a reduction in the number of sprays or an increase in the interval between successive sprays resulted in lowering of yield.

Therefore, it is again being recommended that eight weekly applications of Sevin, commencing at first buds, should be made.

AGRONOMY

Mr. J. M. Colyer resigned as Agronomist at the Gatooma Station, at the end of December, 1959, after one year's service with the Ministry of Agriculture. Mr. J. M. Burton, Agronomist, arrived at the Station on first appointment in April, 1960.

During the three-month period which occurred between the departure of Mr. Colyer and the arrival of Mr. Burton, part of the routine of the Agronomist's programme of experiments was maintained, in the first instance, by Mr. B. Tulloch, Natal University, and finally by Mr. C. R. Lotter, a farmer. Both of these gentlemen were employed on a temporary basis.

COTTON

Cotton Variety/Fertilizer Trials

Two trials were planted; one of them followed a green manure crop (pigeon pea), while the other followed maize.

Treatments in both trials were as follows:

Fertilizers

	Nutrient levels: lb./acre			
N as sulphate of ammonia ...	0	60	90	120
K_2O as muriate of potash				

Phosphate was applied as an overall dressing at a rate of 60 lb. P_2O_5 per acre.

Varieties

(a) Albar 637, a plant of fairly vigorous growth and better lint quality than

(b) G52/36 a more compact plant of small growth habit and poorer lint.

The yields from both trials were disappointing. This was undoubtedly due to the very severe drought conditions of last season.

The mean yield of the trial following pigeon peas was 389.6 lb. seed-cotton per acre; and other main results were:

(a) The coefficient of variance was 16.20 per cent.

(b) G52/36 gave a significantly higher yield of seed-cotton than Albar 637 at the 5 per cent. level.

(c) G52/36, where it received the maximum levels of nitrogen and potash ($N=120$, $K_2O=90$) was significant at the 5 per cent. level.

The mean yield of the trial following maize was 160.2 lb. seed-cotton per acre; and other main results were:

(a) The coefficient of variance was 58.34 per cent.

(b) The two replications (each replication comprising one block) were significantly different at the 5 per cent. level, a most unsatisfactory result due, no doubt, to the drought, and also to certain limitations in the design of the experiment, which have since been rectified.

(c) There were no statistically significant differences between varieties or between fertilizer treatments.

CROPS OTHER THAN COTTON

CROP PRODUCTION TRIAL

This trial was arranged for the Division of Chemistry, Salisbury. The objectives are to determine differences in productivity due to varying rotations and their effect on soil plant relationships, soil nutrient status, and soil structure.

Treatments

Crop Rotations—

(i) Maize continuous.
(ii) Maize, cotton, maize, in three phases.
(iii) Legume green crop (L.G.C.), maize, maize, in three phases.
(iv) Legume hay, maize, maize, in three phases.
(v) Grass 3 years, maize 3 years.

Plant Residues. Plots were split transversely with the removal of plant residues from the one half, and the ploughing-in of crop residues in the other.

Fertilizer. The fourteen-row plots were split longitudinally so that seven rows received 100 lb. nitrogen per acre and the remaining seven rows received 50 lb. nitrogen per acre.

Basic overall applications of 50 lb. P_2O_5 per acre and 30 lb. K_2O per acre are given.

The trial is not statistically designed, therefore the various treatment effects will be assessed by inspection of plots and certain measurements, and not by statistical analysis.

The mean yield of maize was 9.58 bags per acre.

The mean yield of cotton was 144 lb. seed-cotton per acre.

The trial has run one season and, as expected, no results of interest have yet emerged.

MAIZE COB ROT TRIALS (two)

These two experiments were arranged at Gatooma for the Division of Botany and Plant Pathology. Treatments and measurements are aimed at investigating cob rots in maize in both trials.

Maize Cob Rot Trial I

Cultivation Treatments—"Clean" residues removed.
"Trash" residues left on surface.

Nitrogen/Fertilizer Applications—N_0 = No nitrogen
N_1 = 50 lb. nitrogen per acre as urea
N^2 = 100 lb. nitrogen per acre as urea

Basic overall applications of 60 lb. P_2O_5 per acre and 40 lb. K_2O per acre were given.

Maize Cob Rot Trial II

Treatments— (i) Maize–Maize.
(ii) Maize–Green crop.
(iii) Green crop–Maize.

Basic overall applications of fertilizer per acre were: 60 lb. P_2O_5; 40 lb. K_2O and 40 lb. N.

The experiments have been under way for one season only, and as expected, no treatment effects were evident.

SULPHUR TRIAL

The object of the trial, which is being conducted for the Division of Chemistry, is to determine the effect of sulphur as compared with no sulphur in fertilizer dressings, by measuring yields throughout the crop rotation, which is one of legume, cotton, maize.

Treatments. Three levels of gypsum: 0, 100, 200 lb. per acre. In addition, basic dressings of 225 lb. per acre superphosphate (double) and 50 lb. per acre muriate of potash were given to all plots. Also, 200 lb. per acre nitrolime will be applied to cotton and 400 lb. per acre to maize.

The trial has run one season, when it was planted to a green crop (pigeon pea). it will be sown to cotton in 1960/61.

KENAF

Kenaf Variety Trials. Two Kenaf Variety Trials planted at Gatooma were abandoned mainly due to discrepancies in the labelling of the plots. However, results obtained from the Kenaf Replicated Single Row Trials conducted at Shamva I.C.A. and Karoi were as follows:

SUMMARY OF YIELDS IN TERMS OF GREEN STALK WEIGHTS AT SHAMVA I.C.A.

Yield of Kenaf	1 BG52–7	2 Cuba 2032	3 Cubano	4 Cuba selec.	5 Salvador NK 50–71	Mean	S.E.	S.D. P=0·5	S.D. P=0·1
lb. per plot	19·4	17·0	14·6	13·4	8·1	14·5	1·015	2·99	4·08
In per cent.	133·6	117·1	100·5	92·3	55·7	100	6·99	19·9	28·1

Plot size 0·0095 acre. C.V. = 17·1%

SUMMARY OF YIELDS IN TERMS OF GREEN STALK WEIGHT AT KAROI

Yield of Kenaf	1 Cubano NK 58–71	2 BG52–7 NK 80–85	3 Cuba 2032	4 Cuba selec.	5 Java Ex. Sves.	Mean	S.E.	S.D. P=·05	S.D. P=0·1
lb. per plot	42·6	37·5	33·2	33·1	19·6	33·2	2·813	8·298	11·317
In per cent.	128·2	112·8	99·9	99·6	58·9	100	8·46	24·97	34·05

Plot size 0·0095 acre. C.V. = 20·73%

Kenaf Spacing/Fertilizer Trial. This trial was also abandoned because of discrepancies between the field plan and the labelling of plots.

Kenaf Multiplication. Seed of kenaf variety NK57/2, which had been produced from a one-acre plot, planted in 1958-59 was again multiplied in 1959-60. Thirty bags each containing 180 lb. of seed were harvested from a crop of 20 acres, which was grown under conditions of severe drought. In view of the decline in interest in kenaf in Southern Rhodesia, it appears likely that further multiplication will not be required.

PIGEON PEAS OR DHAL *(Cajanus cajan)*

Yields of pigeon pea seed from the collection maintained at Gatooma was disappointing, as a result of considerable damage caused by insects.

The demand for different varieties of pigeon peas is quite considerable, especially from the Department of Native Agriculture, where increased interest in the crop appears to be evident.

CROP TRIALS FOR OTHER STATIONS

The Maize and Sorghum Variety Trials, planted at Gatooma for Matopos Research Station, as well as a Maize Variety Trial sown for Salisbury Experiment Station were all failures, due to severe drought conditions and high plant populations.

The Federal Lucerne Variety Trial, grown under irrigation on Eiffel Blue Farm (Mr. D. Blyth) over the past two years, was terminated, due to a shortage of borehole water for irrigation. The trial was planted in July, 1958, and the final cut, the fourteenth, was taken on the 26th of May, 1960. Yield figures have been submitted to the appropriate committee in Salisbury for analysis.

On the decision of the different officers concerned, variety trials with wheat, groundnuts, and castor beans were not planted at Gatooma in 1959-60.

(1) GINNING OF THE 1960 COTTON CROP AND

(2) ACID-DELINTING AND ISSUE OF PLANTING-SEED TO GROWERS

As a direct result of the sale of the Government-sponsored Cotton Industry Board's Spinning Mills at Gatooma to Messrs. Rhodesian Spinners (Pvt.) Ltd., the ginning of the 1960 cotton crop, the sale of lint, and the acid-delinting of ginned cotton-seed in order to produce seed for planting, became the responsibility of the Grain Marketing Board, from 1st July, 1960. As an outcome of this new arrangement, the Officer-in-charge, and the Farm Manager, Gatooma Research Station, were called upon to give considerable assistance with the ginning, acid delinting and issue of planting seed to growers. Furthermore, Mr. F. A. E. Green, a retired farmer, with valuable experience of seed-cotton classification, became an employee of the Grain Marketing Board, and assisted ably with acid delinting and certain aspects of ginning.

Ginning. By arrangement the Grain Marketing Board obtained the services of Messrs. Rhodesian Spinners (Pvt.) Ltd., for the operation and maintenance of the actual ginning machinery at Gatooma. However, other aspects of ginning, such as the examination of seed-cotton on the mixing floor and the taking of lint samples were supervised by Mr. Green in consultation with the Officer-in-charge, Gatooma Station.

In a number of instances it was found necessary to down-grade seed-cotton, which had been classified previously, on the mixing floor. Thus, for example, Class 1 was down-graded to Class 2 or even to Class 3. Such action resulted in heavy financial loss to Government, as payments to growers had already been made on the basis of the higher classification. Moreover, such errors in classification resulted in certain growers obtaining false information on the true worth of their crops.

The 1960-61 cotton crop was ginned over the period 1st August to 26th September, 1960, inclusive. A total of 1,490 bales of lint (400 lb. bales) was produced. This figure may be compared with the production of 839 bales in 1958-59 and 735 bales in 1957-58. The increases in production are due very largely to increases in acreage planted to cotton in the Sabi Valley.

Under commercial ginning conditions, Albar 637, the "new" variety, now issued to all cotton growers for planting in 1960/61, showed an improvement over 9L34, the "old" variety, of approximately 1 per cent. in ginning outturn. The improvement was obtained both in the rain-grown and irrigated crops, from Class 1 seed-cotton. The ginning outturns for Albar 637 grown under irrigation and under rainfall conditions were 32.6 per cent. and 33.6 per cent. respectively. Therefore, Albar 637 also gave a 1 per cent. higher ginning outturn when grown under rainfall.

Acid-delinting and Issue of Cotton-Seed. Except for the financial and accountancy aspects, production of acid delinted cotton-seed for planting as well as the distribution of the treated seed to individual growers, were both conducted entirely by the Staff of the Research Station assisted by Mr. F. A. E. Green. Eighteen of the Station's African employees were also engaged on acid-delinting, which was started on the 20th September and completed on the 24th October, 1960, a period of 30 working days.

A total of 84,218 lb. (approximately 42 tons) of water-sinking seed of the variety Albar 637 was obtained by acid-delinting approximately 70 tons of ginned seed with sulphuric acid. Of the total quantity of sinker-seed, 70,224 lb. was sold to growers for planting the 1960-61 crop. The balance, namely 13,994 lb., is available, as a reserve stock of acid-delinted seed. Also held in reserve are approximately 40 tons of ginned seed of Albar 637. This latter will probably be acid-delinted in 1961.

In addition to the 70,224 lb. of acid-delinted seed issued, a few growers bought between them 2,725 lb. of ginned or fuzzy seed for planting in 1960-61.

Comparable figures for seed sold for planting the 1959-60 crop are 65,957 lb. acid-delinted and 200 lb. ginned seed.

As indicated, Albar 637 was the only variety of which seed was issued for the planting of commercial crops in 1960-61. Once again growers of cotton which is planted under irrigation, in areas to the east of the Sabi River, bought a high percentage of the total seed issued, but there was an even greater demand for seed by growers situated in lower altitude areas to the west of the river, in the Ndanga district.

In areas, at the higher altitudes, where the crop is grown under rainfall conditions, there appears to be a revival of interest, based on seed issues, by growers in the Mazoe Valley.

GRASSLANDS RESEARCH STATION

H. D. L. CORBY, *Officer-in-Charge*

The Grasslands Research Station, at Marandellas, serves the agriculture of some 12½ million acres of sandy country in north-eastern Southern Rhodesia, where the rainfall is usually sufficient, and sufficiently reliable, for arable farming without irrigation.

Within its means, the Station deals with all aspects of the agriculture of its region except tobacco, and there it works by offering its facilities and co-operation to the Tobacco Research Board of Rhodesia and Nyasaland.

As its main task the Station is seeking means of maintaining and raising soil productivity. It is belived that the sandy soils of the region, once brought into cultivation, can best be preserved for continuing agricultural use by some system of ley farming, and much of the work of the Station derives from this belief. There is some work too with veld, vlei, and irrigation.

The Station covers some 6,700 acres. It has a staff of 31, of whom 15 are European and 16 African.

WEATHER

The rains came in good time and planting went with a swing. By the New Year, however, when most of the country was in the grip of severe drought, most of the Station's crops were suffering from too much rain; a month later they were suffering from too little. In contrast to most crops, early-planted groundnuts and potatoes flourished and experimental yields of 2,200 lb. of shelled groundnuts and 36,900 lb. of potatoes per acre were obtained. Cattle on natural grazing began to lose weight earlier than usual in the dry season, but by its end had lost less than expected. Rainfall for the year was 0.81 in. below average at 35.29 in. The winter was mild, with 43 frosts.

EXPERIMENTAL WORK

Over seventy experiments, involving some 3,300 plots and some 720 animal-periods, were done during the year.

LEGUMES

Sixteen experiments involving 1,800 plots and 260 pots were done during the year, and good progress was made in the *Rhizobium* laboratory established to back work in this field.

During its second year, as during its first, the work of the laboratory for dealing with the legume bacteria was mainly concerned with developing techniques and gathering bacteriological material. The *Rhizobium* collection now contains 342 strains from 51 different species of legumes, 112 of these strains having been acquired from other laboratories.

Adequate control of greenhouse temperatures has still to be achieved, so, much to our disappointment, no greenhouse-tests of the nitrogen-fixing efficiency of strains of *Rhizobium* have been done. However, 130 strains were taken direct to the field for test on six species of legumes; results with soya beans and Rueppel's clover and, to a lesser extent, lucerne were most encouraging.

About 220 cultures of *Rhizobium* were prepared for other research stations and laboratories and for experimental plantings by farmers.

Experiments with groundnuts have sustained last year's finding that early-planting is of great importance, and have shown that a small dressing of nitrogenous fertilizer at planting increases yield. Experiments with soya beans, in contrast to those with groundnuts, were more or less vitiated by the vagaries of the season.

On completing a three-year comparison of 25 varieties of summer lucerne (i.e. un-irrigated lucerne), it was found that the variety Chilean 21-5 had given the greatest average yield, with 3,700 lb. of fodder dry matter per acre per season. California Common, Williamsburg, and Hairy Peruvian were next in order of average seasonal yield.

In comparing various grass-clover mixtures on different plots under irrigation it was found that the prsence of clover in the mixtures greatly increased the growth of grass. This is noteworthy as indicating a transfer of clover-fixed nitrogen in circumstances in which it is not generally held to occur.

Peas grown under irrigation for seed grew very healthily and gave experimental yields of over 2,000 lb. of seed per acre.

Over a hundred varieties of clovers and trefoils were grown on land deliberately infested with the root-knot-nematode. *Meloidogyne javanica,* to assess their powers of resistance to its attack. All varieties of clover and all but two varieties of trefoil were severely infested.

Grasses

Grasses, as the basis of the Station's work with leys, receive much attention, and study of their culture and use has been continued.

To provide a sound basis for local grassland management a series of experiments is in progress in which the relative severity of various defoliations is assessed by measuring subsequent recovery from defoliation. With Star Grass this year, as with Sabi Panicum last year, it has been found that frequent and/or untimely cutting in one season reduces growth in the following season, and that this effect is not countered by applying large rather than moderate dressings of nitrogenous fertilizer or by cutting high (5 in.) rather than low (2 in.).

In a comparison of four grasses for use as winter forage, steers gained an average of 60 lb. and 30 lb. each on Sabi Panicum and Kazungula Setaria respectively during the months from June to September, while comparable groups lost 20 lb. and 110 lb. respectively on Katambora Rhodes Grass and Ermelo Love Grass. On the same grasses in early summer (until late January) gains were 310 lb., 240 lb., 180 lb., and 300 lb. per acre respectively.

In comparing forms of nitrogenous fertilizer for use on grass, with Sabi Panicum, no material difference in response to ammonium sulphate and nitro-lime was found, nor was response affected by applying lime at the same time.

For the second season running Sabi Panicum grown in 3-ft. rows has responded more vigorously to nitrogenous fertilizer than that grown as a sward. Further, in the most recent cutting, but not those preceding it, the increase in yield accompanying increasing quantities of nitrogenous fertilizer was greater with rows than with the sward.

In the Nursery some 230 plantings, mainly grasses, were watched during the year.

Maize and Potatoes

A new herbicide was tested in maize in co-operation with Messrs. African Explosives and Chemical Industries (Rhodesia) Limited. When applied as a pre-emergence spray it controlled weeds effectively for a month, but one hoeing after that was necessary to secure a satisfactory yield. Equally satisfactory yields were obtained by hoeing twice and using no herbicide at all.

In a comparison of varieties of potatoes, all early-planted, well-fertilized and grown as a summer crop, the variety Loman 43.35 gave 36,900 lb. of tubers per acre.

Livestock

Nineteen experiments with livestock, involving nearly 700 animal-periods, have been done during the year, and have been mainly concerned with the use of local feeds. Much of the work is mentioned or implied elsewhere in this report.

A four-year study of the effects of nutrition on infertility in ranch cows, done in co-operation with the Department of Veterinary Research, has been completed. There would appear to be no infertility of nutritional origin in beef cows running on the natural veld grazing of the Station.

Two-year-old beef steers and heifers, running on natural veld grazing and having had cobalt "bullets" since weaning, are not apparently different from corresponding animals which have had no "bullets".

Continued assessment of the value of irrigated grass-clover pastures has sustained last year's finding that maize-meal is a satisfactory concentrate for dairy cows grazing such pastures, and that meals of higher protein content need not be used. Other work has shown that such pasturage, cut and fed as a concentrate replacement, may be used to replace half, but not all the conventional concentrate ration.

With dairy calves it has been shown that additions of vitamin A are of value to calves raised on skim-milk powder, especially in winter, but of no apparent value to those raised on whole-milk.

With sheep an attempt to raise worm-free sheep on worm-free pastures has been continued. With no dosing of any kind, and confined to a small area of pasture, the sheep remained apparently free of infestation for just over a year.

Study of producing lambs for slaughter at weaning, at twelve to sixteen weeks of age has been continued. It is clear that lambs of adequate weight and quality can be produced; in their breeding, however, the lambs so far used have lacked the perfection of conformation found in their Australian and New Zealand counterparts.

Assessment of the digestibility of local fodders, using caged sheep, has been continued; five trials have been done during the year.

Effects of Leys

Nine experiments to assess the effects of leys and ley management on soil productivity have been continued. The first and oldest of these after four years under grass, was test-cropped with maize and tobacco during the year. With the maize it was found that the greater the amount of nitrogenous fertilizer that had gone on the grass the greater was the yield of the following test-crop of maize; the increase in yield with increasing amounts of nitrogen, however, was less than had been hoped for and expected. It was found also that the yield of maize was greater where the ley had been grazed than where it had not, and greater where it had been grazed heavily than where it had been grazed lightly. Somewhat similar results have been reported by the Tobacco Research Board in the case of the tobacco test-crop. With both crops, however, the vagaries of the rainy season obscured the issue.

Veld

Seven experiments comprising studies of veld-management systems, effects of burning, effects of prolonged overgrazing, and methods of killing trees and coppice have been continued.

Vlei

Assessment of the value of fertilizers in establishing Nile grass in sandveld vleis has shown that nitrogenous and phosphatic fertilizers, but not lime, are of value. From pot experiments with Rueppell's clover there is an indication that sulphur may be deficient in sandveld vlei soils.

In co-operation with the Department of Conservation and Extension, studies e-drainage of vlei land have been continued.

Irrigation

Four experiments were done with irrigated crops; they have already been mentioned under "Legumes" and "Livestock".

The Chemistry Laboratory

Some 2,400 herbage samples have been analysed during the year, mainly for their content of crude protein.

EXTENSION

Four Farmers' Days and two machinery demonstrations were held, and 24 parties of various kinds visited the Station. In all it is estimated that about a thousand visitors came to the Station.

In addition to the numerous talks and lectures given to visitors to the Station 27 more were given in the districts, 17 special advisory visits to farmers were made, and judges were provided on three occasions. Twenty-six committee meetings and three conferences were attended.

Nearly 350 bags of grass roots and 65 samples of seed were dispatched to six different countries. In addition, farmers were provided with large quantities of grass roots which they dug themselves. Some 200 cultures of *Rhizobium* were distributed to other stations and laboratories.

In keeping with the theme ("Agriculture and the Townsman") of the Ministry of Agriculture's contribution to the Salisbury Show, the Station staged an exhibit showing how research into the culture of maize has contributed to food supplies. An exhibit of the work of the bacteriological laboratory was staged in Madison, Wisconsin, for the VIIth International Congress of Soil Science.

Eight papers and articles were prepared and/or published during the year.

STATION MATTERS

Staff

With only one change of European staff and two of African staff, staffing during the year was satisfactorily stable. Officers were on vacation leave for 362 days, sick leave for 108 days, occasional leave for 49 days, and study leave for 23 days. One officer was away also for ten days on military service.

Farm Cropping

In the Station's arable rotation, which covers some 602 acres, there were during the year some 405 acres of planted grassland, 58 acres of maize for grain, 22 acres of maize for silage, 19 acres of soya beans for hay, 74 acres of compound crops and 24 acres of fallow. In addition there were 34 acres of irrigated pasture half of which was replanted during the year. Yields of summer crops were generally low as a result of adverse weather.

Farm Livestock

The Station's livestock included 79 dairy stock, 372 beef stock and 116 sheep at the end of the year.

In the dairy herd the average output of milk for all lactations completed during the year, including those of first-calf heifers, was 10,615 lb. per 300-day lactation, with an average of 3.72 per cent. butterfat.

Seventy weaner steers were bought and 137 sold on graziers' agreements with the Cold Storage Commission.

Revenue from Sales of meat and milk amounted to £5,630.

African School

The Station's African School has been enlarged to cater for Standard 3 as well as the lower classes. At the end of the year there were 116 pupils, 61 of them being boys and 55 girls. Sixty-four of the pupils are children of the Station's employees, while the remainder come from the surrounding district.

The headmaster, Mr. Cyprian Tseriwa, attended the Olympic Games in August.

The Station's thanks are due to Mrs. D. L. Barnes for her supervision during the year.

Estate

Three houses for African staff, an additional office, and a bull-pen were built, the greenhouse was enlarged, and a new African school house was partly built.

Four miles of old fencing were removed and eight miles erected. Three miles of new roads were built.

ACKNOWLEDGEMENTS

Very generous gifts of fertilizer were received from Messrs. Fisons (Rhodesia) Ltd., Messrs. Windmill Fertilizers (Rhodesia) Ltd., and Messrs. African Explosives and Chemical Industries (Rhodesia) Ltd.

HENDERSON RESEARCH STATION

Dr. J. W. ROWLAND, *Officer-in-Charge*

GENERAL

The Henderson Research Station lies in the centre of the maize growing area of Mashonaland and is concerned with the improvement of agriculture on the loam soils. With an average rainfall of 35 inches the region lends itself to intensive production from crops, pastures and livestock. In the current year the rains came late and in comparatively small amounts, but growth, although somewhat less than usual, permitted the reaping of maize crops of 18 bags and more per acre. Erosion was negligible. The absence of protracted heavy rains created favourable grazing conditions and the late autumn rain provided unusually green herbage well into the winter.

European Staff. Throughout the year the staff has been up to strength and all residential accommodation has been occupied. One Professional Officer and one Clerical Officer have lived away from the Station due to a shortage of accommodation.

Farm Development. All roads were maintained and considerably improved through gravelling, draining and the construction of bridges and culverts. A main road to serve the sandveld was made. General maintenance of all existing buildings and fencing has been done and a security fence has been erected round the main farm buildings. In addition to the provision of 10 African latrines, an implement shed was completed on the Fisheries Section. Five spawning ponds together with additional outlet sluices on existing ponds were constructed to facilitate Fisheries research. The estate plantations have been improved and extended with further plantings of trees. Despite the lack of funds, and suitably trained staff, the Station's laboratory is now in operation and certain routine analyses are being undertaken. The Assembly Hall and Amphitheatre which are being built from funds subscribed by the Henderson Research Station Agricultural Society, are nearing completion.

Visitors and Advisory Visits. The number of local and overseas visitors to the Station has increased to an extent where it is impossible to maintain an accurate individual record. In addition, all requests for advisory visits, specialized lectures and addresses have been met by the Station Staff.

GENERAL NOTES ON RESEARCH

In this somewhat dry year it has become clear that high populations and fertilizer usage can increase drought resistance—within limits. The emphasis in research has been changed somewhat by the new conditions in which fear of surpluses has replaced the need which has existed hitherto to increase production to meet local requirements.

Beyond doubt production has increased as a result of the better use of mechanization, fertilizers, insecticides and fungicides, and the use of better seeds and stock and feeding methods. It has been ruefully stated that although these innovations have increased production they have not lowered costs of production.

It is now an urgent matter to carry research into ways and means of associating increased production with lower costs per unit of product.

There is an immense field for the further application of existing knowledge, but the resulting production increases must give the farmer a profit in the prices offering. The prices offering for greatly increased supplies of maize, milk and meats other than beef are inevitably industrial or export prices, much below those set on the local consumers' market. Everything possible is, therefore, being done to open up lines of research which will provide the knowledge of how to negotiate the present situation.

On grounds of conservation, high populations of maize are inescapable. These must be associated with appropriate fertilizers and greatly increased maize yields are to be expected, on both European and African maize fields. To avoid limitation by quotas and to avoid the miseries of overproduction and loss, a profit must be found within the limits of export or local industrial prices.

In this the research in progress gives grounds for optimism. In the current year, the costed 300-acre intensive farm unit—in spite of the dry conditions has increased production to a gross product comprising milk, maize, grain and natural increase of cattle to a value exceeding £10,000. The tenant operator is making a substantial profit.

In other spheres, research on beef and on seasonal milk production is showing promise of lowering costs per unit of product. A recent costing survey has shown that farmers' costs per bag of maize are lowest where yields are high, and this confirms the observations made on this Station.

The work of lowering costs of production is being directed along orthodox lines of reducing overheads, wages and other charges, and on the 300-acre unit a determined effort is being made to find a profit in 1s. 9d. per gallon of milk and 20s. per bag of maize. The means whereby this is sought are a doubling of production from today's 140 gallons to 250, the employment of skilled European and African labour in place of unskilled Africans and concentration on forage crops and appropriate organization and mechanization in both barn and field.

In the near future this 300-acre unit, which is now running 130 head of cattle, of which 70 are milking, will be increasing the cow herd very considerably. The dairy, barn and yard layout, together with the general organization and handling of livestock, pastures and crops are all being recast in the light of information and experience gained, in order to reduce production costs and to increase production at the same time.

The crop research has developed in the main towards experiments on vegetable seeds, lucerne, winter cereals, potatoes, tomatoes, cauliflowers and onions, all under irrigation, and to critical studies of water economy on these soils. The work on protein metabolism by various ages and classes of cattle—including the local Mashona breed—and the studies of forage sequences and pasture rotations is progressing favourably.

The river, which for the past eight years has provided ample water for all requirements, has been low this winter and water shortage has interfered seriously with fisheries, agronomy and unit research programmes. Insurance of adequate and reliable water is a serious need.

The Henderson Research Station Agricultural Scientific Society has held regular monthly meetings which have been well attended.

PASTURE RESEARCH SECTION

The research programme is designed to investigate pastures against a background of maize production, and to establish their use in providing satisfactory nutritional planes for various classes of livestock.

Major utilization trials have clearly shown that the winter roughage requirements for a mature beef animal can be obtained from two acres of veld, or one acre maize stover or three-quarters of an acre of foggage pasture used as late-cut hay. The provision of this feed presents little difficulty and under normal conditions there is sufficient winter feed to support large numbers of animals.

Intensification of livestock production to higher levels is limited by the availability of summer grazing and, under traditional usage of veld for this purpose, it is difficult to reconcile winter and summer carrying capacities. Principles of veld management stress the need for bush control measures mainly through moderation of summer stocking and the use of periodic fires. Following these principles, it appears that 10 acres of veld are required to ensure maintenance of the veld and satisfactory nutritional conditions for one animal during summer.

In many instances, the degree of permissible intensification (where existing principles of veld management are applicable) has been exceeded and there is little doubt that these instances will be multiplied in the immediate future. There is thus an urgent need to implement a new set of principles which will provide for a higher degree of intensification which will ensure the stability of the veld and at the same time provide an adequate level of nutrition to the grazing animals.

It has been firmly established that a major role of nitrogen as a fertilizer on pastures is to increase the productivity of herbage. In this manner, increasing applications of nitrogen result in higher carrying capacities. Experiments indicate that where applications of nitrogen are in the order of 80 lb. per acre, one acre of pasture will provide 26 weeks of summer grazing for a mature animal. The most effective use of improved pastures is, therefore, to relieve grazing pressure on the veld during critical periods of summer growth.

The adoption of this principle leads directly to the simplification of the forage sequence and provides a higher nutritional plane than obtains under the commonly accepted concept of veld for summer grazing and conserved feed from arable sources for winter. Attention is drawn to the fact that the animal can in the manner suggested obtain both its summer and winter roughage requirements through grazing, and the cost of mechanization can be greatly reduced thereby. Further, the use of veld for winter roughage facilities stability and simplifies the management system. There is thus a clear indication that livestock production can be intensified to a high degree under stable and satisfactory conditions.

The necessary winter protein supplement has been successfully provided in the form of jack-bean silage. Despite the difficult season, yields in excess of five tons of edible silage per acre were recorded and this was readily taken by all classes of cattle.

Investigations were initiated into the use of Desmodium discolor as a protein supplement to autumn pasture grazing. There appear to be no insuperable difficulties in establishing the legume from seed and maintaining it in monospecific stands. It has been shown, however, that the plant takes a period of some two or three years to develop fully and this presents difficulties where the plant is used in leys of relatively short duration. Future investigations will, therefore, be directed towards the trial of this plant as a source of protein. It is readily taken at any stage of growth by the grazing animal and recovery growth is rapid.

A study of the carbohydrate-protein relationships in a number of grasses has been started. The object of this investigation is to establish criteria for the selection of species which will provide feed of satisfactory quality over an extended grazing season.

FIELD HUSBANDRY AND IRRIGATION SECTION

The dryland programme has been considerably reduced and increased emphasis is being placed on vegetables and other irrigation crops.

Despite badly distributed rains the dryland maize, cotton and groundnuts yielded well. Land in its seventh year of trashed continuous maize yielded 23.1 bags per acre while the alternate maize/green manure system was slightly better (25.9 bags per acre). These differences may, however, be seasonal. In the fertilizer experiments maize still responded to nitrogn applications but not as well as in better years (300 lb. calcium ammonium nitrate per acre gave 14.1 bags per acre; 450 lb. calcium ammonium nitrate per acre gave 16.2 bags per acre and 600 lb. calcium ammonium nitrate per acre gave 17.2 bags per acre). A two bag increase was obtained from an application of 50 lb. muriate of potash per acre. There were no differences in yield due to three forms and times of application of nitrogen.

In the newly started experiment maize following munga as a green manure crop produced a greater yield than when it followed soya beans.

Early planted cotton (mid-October and early November) once again yielded better than later plantings. A considerable amount of promising groundnut material emerged from the past season's work.

The irrigation programme progressed well though it still faces danger of a lack of water. In order to ensure continuity in the irrigation research programme, it is essential that a storage dam be built in the catchment area of the present water supply.

Lucerne responded well to phosphate and boron applications. The varieties India, Hairy Peruvian, S.A. Standard, Hunter's River, Caliverde and New Mexico 11-1 gave similar yields. When cut at the 10 per cent. flowering stage and when sown in 9-inch drills or broadcast, lucerne performed the best. Potatoes and beans responded poorly to various nitrogen, phosphate and potash levels but beans did respond to an application of 10 tons of kraal compost per acre. Cauliflowers responded well to applications of boron, phosphate and nitrogen, and to a lesser extent to molybdenum.

ANIMAL HUSBANDRY SECTION

Digestion Trials and Herbage Consumption Studies

In the past few years a comprehensive series of trials have been carried out to obtain a suitable method of studying the herbage consumption of the free-grazing animal under veld conditions. This work has shown that the use of chromic oxide as an inert tracer for the estimation of faecal production provides an accurate measure. Further, the use of the faecal nitrogen concentration has been shown to be a valid method of estimating the digestibility of the consumed forage. These findings are in agreement with observations made overseas. This technique has made it possible to study in detail the changes in the nutritional status of grazing animals on veld grazing and it has considerably increased the precision with which supplementary feeding programmes can be planned.

Over the past two years the technique has been applied in studying the herbage consumption and nutrient intake of dry and lactating Africander and Mashona cows. The data so far indicate the following:

Feed consumption capacities of the two breeds appear to be related to the metabolic size and not directly to weight. There is a marked seasonal change in appetite which is closely related to the digestibility of the consumed feed. Apparently the limitation is determined by the ability of the digestive tract to deal with indigestible feed residues. The effect of lactation on feed consumption under free-grazing conditions is to cause a stimulation of appetite by approximately 25 per cent.

There is some evidence that the smaller cattle (Mashonas) consume feed of higher digestibility and digestible protein content than the larger Africanders. Relating the performance to nutrient intake it appears that at the higher levels of nutrient intake (above the equivalent of 0.75 lb. live-weight gain) the Africanders are more efficient in nutrient utilization than the Mashonas while the reverse is true at the lower levels. Thus, the computed maintenance requirements of the Mashona are relatively lower than for the Africanders. Remarkable precision appears to have been possible in these estimates since theoretical maintenance requirements agree very closely with those found in this work.

It is intended that this study be altered to include various age groups of growing young stock of these two breeds.

Fertility Studies in Beef Cattle

This long-term project has continued without interruption for five years and is due for termination in June, 1961. The original projects will, however, be replaced by other studies on this most important subject of fundamental interest to any increased beef production in this country. The results to date have clearly shown the overriding importance of supplementary protein in preventing weight losses during the six months of winter. These weight losses, amounting to as much as 15 per cent. of the body weight in unfed cows, are the direct cause of poor reproductional performance. It appears as if the effect of the protein supplementation during the winter has no specific effect on fertility. It appears, rather, as if poor fertility is associated with poor body condition. It is logical to assume, therefore, that any factors likely to improve the body weight and assist in maintaining the weight equilibrium from one reproductional cycle to the next is likely to contribute to an improvement in fertility.

The effect of supplementary protein has become obvious as already mentioned. In addition, it has been noted that the size of the grazing animal has an important bearing on its ability to withstand protein stress during the winter months. It has been proposed that smaller type cows (of which the indigenous types are a good example) are better adapted to the existing nutritional environment than the larger types, and this may be an explanation for their reputed fertility under veld conditions. The importance of lactational stress in affecting the overall protein economy of the beef breeding cow has also been clearly shown in this work, and ceilings of performance is this regard appear desirable when selections are made within this environmental complex.

Some observations have also been made on the effect of mineral additions to veld grazing on the reproductive performance of breeding cows. Their effects appear to be negligible on body condition of the dam but they seem to have a slight effect (mainly phosphorus) on fertility and lactation.

Growth Studies in Beef Cattle

The effects of protein and mineral additions on the growth and mineral storage of growing beef cattle under veld conditions have also been under study for the past few years.

Briefly, in addition to protein responses the effects of phosphorus, cobalt and copper supplements on body weight, blood phosphorus and haemoglobin, liver cobalt and copper stores and the total ash accumulation of the major bones of the fore- and hind-legs are being studied in detail. Representative animals on these various treatments are slaughtered at six-monthly intervals from weaning to 2½ years of age. These slaughterings coincide with the end of winter (October) and the end of summer (May) each year.

No stimulatory effects of the various minerals on growth in body weight have been noted. In all cattle, liver cobalt, copper, and blood phosphorus values, whether receiving supplements or not, have been within what are considered to be "normal" ranges. The provision of supplementary protein during the winter clearly dominates the treatment effects and again in this regard, differences in age (or size) tolerance to protein deficiencies under grazing conditions have been noted.

Nitrogen Balance Studies

Throughout all the studies on ruminant nutrition in this environment the provision of supplementary protein or non-protein nitrogen clearly exert major effects on growth and reproduction. It was considered logical, therefore, that more fundamental studies should be undertaken on the nitrogen metabolism of the ruminant, and to obtain more precise information on the input-output relationships of this important nutrient. Suitable facilities have been constructed for these studies and a start has been made in determining the factors which influence the biological values (or net productive values) of dietary proteins when fed to various classes of beef cattle. It is anticipated that a better understanding of the factors involved in the utilization of protein by cattle will lead to methods of improving the efficiency with which this nutrient is utilized by ruminants under local practical conditions.

It is also intended that these studies include observations on the relative efficiency with which various breeds of cattle utilize available protein so that explanations can be obtained of observed differences between breeds under field conditions.

Sheep Production

The original project on studying the parasite burden of sheep in this area and the effects of various drenching treatments in controlling these parasites has been completed. This data gave a broad pattern of the seasonal change in parasite infestation and a number of interesting factors requiring further study were brought to light. Requests for funds for the purchase of suitable experimental animals to pursue these problems was, unfortunately, refused and this work has been discontinued.

Other Research Activities

It has been possible in the last year to co-operate with other Departments on a number of research projects not covered by the Sectional research programme. For instance, a number of cattle have been made available to the Parasitologist of the Veterinary Research Department for studies on the viability of laboratory incubated fluke cercariae and also the effects of artificial infestation with these parasites on growth of young beef cattle.

FISHERIES SECTION

Extension and Development

A considerable number of advisory visits to farms in Mashonaland, Midlands, Fort Victoria, Eastern Districts and Matabeleland were made during the year. In a number of I.C.A.s, informal meetings, demonstrations and lectures on fish management and netting were arranged.

A series of six lectures was given by the Fisheries Officer to second year students at Gwebi College.

Records are being kept of the fishing (angling and commercial) on Mazoe Dam, and the Mazoe Citrus Estate Angling Society are kindly co-operating by keeping angling records. The *Tilapia melanopleura* introduced three years ago have established themselves well and form the bulk of the best catch by anglers. A limited number of *Tilapia macrochir* have been introduced also, and it is hoped that they will make use of the deeper water.

Visits to other angling waters have been made at the request of Angling Societies and the collection of data by them is being encouraged.

Publicity

The Centre was requested to assist in arranging a fish exhibit at the Central Africa Trade Fair in Bulawayo in the Federal Government Pavilion, in May. An exhibit on the integration of pig rearing and fish culture was set up at the Agricultural Show in Salisbury. Specialist staff were in attendance to answer inquiries in both cases.

Meetings and Committees

The Centre was represented on various committees and at various meetings throughout the year. Amongst them may be mentioned the Ministry of Agriculture Weed Control Committee for which a paper on aspects of weed control was prepared.

Savory Dam

During the year under review 1,813 anglers were recorded as fishing in the dam. This represents an angling pressure of approximately 72 fisherman-trips per acre. Over 2,000 lb. weight of fish was taken by angling of which 108 lb. only was *Clarias* (barbel). Commercial fishing in this period gave 543 lb. of *Clarias* and 4,172 lb. of *Tilapia*. Fishing trials have indicated that the best catches per haul are obtained on dark moonless nights.

Production of Bass

A good breeding population of bass is now held. Results of spawning in 1959 were satisfactory and the fry were used for pond experiments and for stocking angling waters and the Savory Dam.

Sale of Fish

During the year fish and other produce to the value of £338 was sold to the staff on the Station, and fish to the value of £372 was sold for stocking purposes.

Research

Research is following the programme approved by the Advisory Committee. Limited spawning of carp was obtained and the young fry were used in growth studies. The improved Dubisch ponds are expected to give better spawning conditions for carp.

The study of the effect of *Clarias* on a pond population was started and this type of work being extended by the study of small numbers of black bass in *Tilapia* production ponds. Production at high stocking rates of mixed sizes was studied. With the intention of integrating fish culture with livestock, trials were carried out on the feeding of fish to pigs. These are continuing.

Suitable methods for drying, smoking and making fish-meal from waste were investigated and will be continued.

More regular observations were carried out on the limnology of both the Mazoe and Savory Dams. Surveys of dams in the Bulawayo area were carried out early in the year by the Chief Fisheries Officer. Sampling of river waters on various journeys is being done where possible and the figures obtained are building up a picture of the variation in the chemical conditions in different rivers.

A short investigation on the fish toxicity of weed-killers to be used on Lake Kariba was carried out for the Lake Kariba Co-ordinating Committee.

Investigations on feeding of *Tilapia* and *Clarias* are continuing.

General

1. In November and December, 1959, the Fisheries Officer took six weeks' vacational leave to attend the F.A.O. Fisheries Training Centre held at Tanga. This covered fishery surveys, economic and marketing problems and general training in fisheries.

2. Three papers from the Centre were read at the First Federal Science Congress in Salisbury in May and two of these will be published in the proceedings.

3. The Chief Fisheries Officer and Fisheries Officer attended the 3rd Symposium on African Inland Fisheries, held at Lusaka in August and each presented one paper.

4. The dry year and increased usage of irrigation water upstream on the Dassura River have resulted in a severe water shortage with over 75 per cent. of the research ponds being unfilled at the start of the summer in 1960.

MATOPOS RESEARCH STATION

(Including the Nyamandhlovu and Tuli Stations)

T. C. D. KENNAN, *Acting Officer-in-Charge*

INTRODUCTION

STAFF

Although the staff position is satisfactory at the present time, numerous vacancies coupled with long delays in obtaining replacements have made the general position highly unsatisfactory during the course of the year. It is to be hoped that more settled conditions will prevail in the future.

HOUSING

Four houses were redecorated during the year. There is an urgent need for two new houses in order that all married members of the staff may be housed.

NATIVE BEER HALL AND SCHOOL

These continue to run satisfactorily. The Cyrene Mission have handed the supervision aspect of the school over to the Matopo Mission.

COMPOUND

No permanent buildings have been erected during the year owing to lack of funds, but a number of pole and dagga huts have been erected as a temporary measure.

CROPS

From a crop point of view the season was very poor but in spite of this 560 tons of maize silage were made from 138 acres and 58 tons of bean hay was reaped from 135 acres.

BILHARZIA AND LIVER FLUKE CAMPAIGN

As the 1959 campaign proved only moderately successful two further sprayings with copper sulphate were carried out during August and September, 1960. Indications to date are very promising.

GENERAL

A large number of farmers' days, conferences and meetings were attended by various members of the staff who also accompanied officers of the Department of Conservation and Extension on numerous advisory visits to farms. Apart from many individual visitors a large number of groups of farmers, conservation officers, scholars and other interested bodies were conducted round the experiments.

FIELD HUSBANDRY

The season was an extremely short one of about 35 days in which some nine inches of rain fell.

DRYLAND AGRONOMY

Of the 40 projects planted, 27 failed completely due to drought, seven were successful and another six were saved by irrigation.

In this very poor season maize populations did not differ and there was no response to nitrogen, whereas phosphorus increased yields. In an identical trial which received an additional 10.33 inches of supplementary irrigation, the results were reversed, with nitrogen giving considerable yield increases and phosphate no response. In the previous three seasons, sorghums planted continuously in 18-inch rows have given the highest yields and this year, in spite of the drought, continuous planting in 27-inch rows gave the highest yields.

In the groundnut trial the quick maturing Valencia gave the best total yields but did not reach the confectionery standard; a wide population range did not differ significantly under dryland conditions although in a trial under supplementary irrigation Valencia yielded over 10 bags (18 lb. decorticated) planted at 1 ft. x 1 in. and all other spacings up to 3 ft. x 12 in. gave lower yields.

In silage trials mean yields were between 10 and 12 tons per acre and here again there was no reduction in yields with the high populations.

Comparisons of crops, times of cutting and methods of making hay in terms of losses, again showed these were from 25 to 50 per cent. but hay made on tripods reduced these considerably.

IRRIGATION AGRONOMY

Summer crops under supplementary irrigation included potatoes in a seed size spacing trial, maize, sorghum and millet in a silage spacing trial and cowpeas and velvet beans in growth analysis studies.

Under permanent irrigation, lucerne varieties ranged in yield from 17.27 to 13.24 tons of dry matter per acre in eight or nine cuts during the year and in the spacings trial with a mean yield of over 12 tons per acre there were no differences between the wide range of spacings.

During the winter, oats, wheat and barley were compared with and without vetch at different planting dates and different frequences of cut.

Soil Moisture Studies

A limited programme of investigation was started on different crops and soils using gypsum blocks and gravimetric methods of soil moisture determination. Scheduling of irrigation based on results of this work has been started.

Plant Breeding

The Matopos made cross, American White X K64v, again topped the maize variety trial results at all localities and sufficient seed was produced to allow trial by farmers in three different parts of Matabeleland. South African maize hybrids again did well in the variety trials.

In the sorghum variety trials, the Fereritas maintained top position with hybrids from Israel and South Africa being high on the list.

Crop Ecology

Due to staff and other difficulties little progress has been possible in the ecological studies.

ANIMAL HUSBANDRY

Despite a very difficult season sufficient bean hay and maize silage was produced to continue the large-scale breeding trials in which a determination is being made of the extent to which beef production can be increased through practising different systems of selection on varying planes of nutrition.

These studies have now been in progress since 1957 and cover most of the major problems confronting beef producers in this area.

From the results obtained so far it is becoming increasingly clear that if beef production is to be increased much more attention should be given to the progeny of bulls. This is clearly shown by the differences obtained in the average weaning weights of calves sired by locally bred and imported bulls.

Fed in Winter

	Grade Herd			*Registered Herd Imported Bulls*	
No. of sire	2	5	6	12	A
Weaning weight of calves ...	438	427	430	462	387

Free Range

No. of sire	4	9	10	11	B
Weaning weight of calves ...	334	366	368	375	343

These differences between sires have been repeated over the past few seasons and the results obtained so far are being examined to determine how progeny testing of beef stock can best be carried out commercially.

Physiological Studies

Determinations were made of the response of native and Hereford cattle to vitamin A and bonemeal when administered with or without a protein-rich feed in winter.

The results obtained so far show that the P_2O_5 content of the blood of Hereford cows tends to be significantly lower than the native cows while independent of breed the feeding of bonemeal has no significant effect on the organic phosphorus content of the blood.

	Mg. P_2O_5/100 ml. Blood
Hereford cows	4.7
Native cows	5.1
Veld grazing	4.6
Veld grazing and bonemeal	4.6
Veld grazing and cotton-seed meal ...	5.1
Veld grazing and cotton-seed and bonemeal	5.2

L.S.D. .05=.22.
L.S.D. .01=.29.

The differences obtained in growth between animals injected with vitamin A and for those dosed against internal parasites when fed or not fed a protein-rich feed in winter are small and more information is required before any conclusions can be drawn on the effect of these treatments and production.

Mutton Production

Satisfactory progress was made with the selection of sheep for non-woolliness and from the management point of view it was shown that provided animals are dosed regularly mutton production can be increased very considerably by lambing in spring instead of during autumn.

POULTRY

Development

Except for the internal fittings, the laying house commenced last year has been completed. An additional wing has been added to the shed housing the birds on the egg-laying test, and the foundations have been laid for the experimental house.

Research

Feed trials started last year were continued. Of particular interest is the degree of fly control obtained where salt is excluded from chick diets, or where it is present in only very small quantities. This reduction in the salt ration results in a reduced water consumption, leading in turn to firmer and drier droppings which are not attractive to flies. Growth rate of the chicks is not adversely affected by the lowered intake of water. Similar observations have been made on mature birds in laying cages, and in such cases no detrimental effects on egg production have been noted.

By feeding grain to chickens from the age of 8 to 12 weeks and thus raising the calorie value of the feed at the expense of protein the growth rate of the chicks is reduced in comparison with that of chicks on an all mash diet. Indications are that protein and carbohydrate in the ration must be increased simultaneously if maximum growth rate is to be maintained.

A trial comparing growth rate of "Chunky Chicks" (specially bred table birds imported from Scotland) with that of locally bred New Hampshires was carried out at the request of private enterprise. Data collected indicated that slightly better growth rate of food conversion rate was achieved by the "Chunky Chicks".

The breeding programme with the aim of improving the table bird characteristics of the New Hampshire is still in progress, and so far the close breeding being practised has not resulted in deterioration in fertility, hatchability and survival rate.

Comparisons carried out over the past two years between chicks raised in cages and chicks raised on floors indicate that the former have a better food conversion rate and grow faster.

General

(a) *Shows:* The Poultry Officer officiated as judge at the Gutu, Gwanda and Wankie Agricultural Shows.

(b) *Extension:* In spite of the very low mileage allocation which was a considerable handicap to advisory work 105 farms were visited and 11 meetings attended. Lectures were given to students at a short course in poultry keeping held at the Gwebi Agricultural College, to members of the local Women's Institute and to young farmers' clubs.

(c) *Visitors:* Forty farmers visited the poultry section during the year.

PASTURE RESEARCH

DEVELOPMENT

Lack of funds has prevented any significant developmental work being carried out during the year, and at both Matopos and Tuli it has been necessary in some cases to shelve the less important maintenance work. At Tuli the position is slightly better and there it has been possible to complete the fencing in two trials and clear a considerable acreage of bush for an extension to another.

RESEARCH. (a) VELD MANAGEMENT

The veld management trials have proved most valuable this year—the driest experienced since 1946/47. The two major points that have been emphasized by these experiments this year have been (a) the value of a correct stocking rate, and (b) the very strong competition that exists between bush and grass. Because Tuli is situated in the driest country these effects have, of course, been most marked there. For instance, steers which are now 45 months old and which are run under a two-paddock/one-herd system of management have, in the past 11 months, gained 74.7 lb. per head when stocked at one beast to ten acres and 303.8 lb. per head when stocked at one beast to 30 acres. For stocking rates of 1:15, 1:20 and 1:25 the respective gains during the same period have been 81.8 lb., 107.3 lb. and 207.3 lb. Also at Tuli, in a comparison of animal response on cleared and uncleared veld it has been interesting to note that where all trees have been removed the grass has, even in this very dry year, responded enormously, grass production from cleared areas being approximately four times that of bushed paddocks. At the same time 21-month-old steers have, in the last 11 months, gained 104.7 lb. more on cleared than on uncleared veld where stocking rate is 1:15 and 122.1 lb. more where the stocking rate is 1:20. Similar results have been obtained at Nyamandhlovu and on the red soils at Matopos. On sandveld and onsoils that are predominantly black at Matopos there is very little variation in the grass species composition and there has also been little variation between responses to stocking rate. There is, however, great difference between degree of utilization and it is likely that erosion will play an important part in bringing about ruination to paddocks that have been stocked more heavily than 1:12.

The useful effect of fire in controlling bush is becoming more and more apparent in trials which have been run under a burning regime for some years, but it is not always easy to obtain satisfactory fires on the red soils at Matopos or, more particularly, at Tuli. The *Terminalia/Burkea* association on the sandveld is apparently much more susceptible to fire than is the *Acacia* on the heavy soils, but even the latter shows considerable thinning after a series of fires.

All cattle at Matopos are wintering badly and they are receiving supplementary protein as and when necessary to save their lives. Yearlings and two-year-olds have, in most cases, been given extra feed since early August and it is likely that by the end of the dry season all animals will have to be supplemented. At Nyamandhlovu the position is particularly critical and some 78 steers have been transferred to Matopos until such time as conditions improve. Only where the stocking rate is high are the Tuli cattle in poor condition.

It is of interest that at Matopos, for the first time since veld management work was started, cattle are doing a considerable amount of browsing in order to supplement their diets. Besides eating the leaves of trees such as *Combretum hereroense, C. apiculatum* and *Pappea capensis* they have completely stripped the bark to a height of over six feet, from many specimens of *Thespesia garckeana, Dichrostachys glomerata* and *Ehretia* sp.

(b) BUSH CONTROL EXPERIMENTS

(1) *Burning.* The burning experiments at Matopos and Nyamandhlovu continue to show that bush can be controlled effectively by fire provided that burning takes place at intervals of about four years and that the burns are timed to take place just before the onset of the main rains. Control of bush by this method is usually slow and is seldom spectacular but if burning is practised regularly good results are achieved. Burning more frequently, particularly annually, is having

damaging effects on the grass and in some of the more severe treatments most of the grass has been eliminated and bush is beginning to re-establish itself. These effects are particularly marked where burning takes place annually in autumn or before any rain has fallen.

(2) *Chemical Control:* One trial incorporating the use of arboricides was carried out at each of the three stations but no results are available yet. Earlier trials have indicated that chemicals (in particular the butyl ester of 245T) are effective in killing some tree species but completely ineffective against others.

(3) *Hand Clearing:* Thinning of bushed areas by hand is being carried out on a large scale. These operations are being costed and in addition various poisons are in use to kill the remaining stumps. A full report on results obtained should be available early next year.

(4) *Control through the use of Goats:* Preliminary data collected from the goat trial at Matopos indicated that goats are effective in reducing the density of bush but insufficient information is available at present regarding optimum stocking rates. Detailed observations have been made during the past year on the feeding habits of the animals. At Tuli it is also apparent that goats can be useful in thinning bush but here again the question of stocking rate needs further investigation.

(c) Plant Succession Experiments

The plant succession experiments continue. These, in brief, indicate the extreme sensitivity of the heavy soils (particularly the red soils at Matopos and Nyamandhlovu) to heavy grazing or continual summer grazing. On these soils the perennial grass cover is very quickly replaced by annuals such as *Eragrostis patentipilosa, Chloris virgata* and *Aristida* spp. At the same time *Acacia* encroachment takes place very rapidly. On the sandveld at Matopos, however, the grass cover is very much more resistant to mismanagement and the tendency has been for the higher successional grass species such as *Hyparrhenia* spp. and *Trachypogon spicatus* to be replaced by prostrate grasses such as *Digitaria pentzii,* a species with a very much greater grazing value. It is not known how long this latter grass will be able to persist under conditions of very heavy grazing but it remains fairly vigorous after 13 years of such treatment.

(d) Veld Fertilizer Experiments

In the past very big increases in yield have been obtained on the sandveld at Matopos from the application of nitrogenous fertilizer. On the black soils the response has been smaller, and on the red soil it has been insignificant. The year under review, being one of particularly ineffective rainfall, was expected to produce valuable results and it was expected that it would be possible to obtain a rough measure of the degree to which moisture is limiting in the response of veld to fertilizer. Unfortunately a speculator trekking cattle through the station deliberately kraaled his animals overnight in the sandveld trial and so the season's results were lost. It was visually apparent, however, that reasonably large responses had been obtained from fertilizer. It is interesting to note that on the black soil highly significant increase in yield was obtained from applications of up to 600 lb. sulphate of ammonia per acre. In this trial the control plots yielded 0.32 tons dry matter per acre but with 600 lb. sulphate of ammonia the yield increased to 1.25 tons per acre. No significant increases in yield were obtained with heavier dressings. No response was obtained on red soil.

(e) Feeding Trials

The mineral feeding trial at Nyamandhlovu had to be discontinued early in the year on account of lack of grazing caused by drought. At this stage steers showed significantly better growth (a live-weight advantage of nearly 100 lb.) when dosed with monosodium phosphate. It is not altogether clear, however, whether the differences in growth rate are attributable to the phosphate dosed or to abnormally poor growth in the control groups and it is desirable to repeat the trial at a later date when sufficient grazing is available.

(f) Dryland Pastures

No critical work was carried out on dryland grass pastures during the year but full use was made of existing pastures for steer grazing and hay requirements. As far as the dryland lucerne trials are concerned two replications on the black soil failed to establish owing to erratic rainfall, but the replications on red soil which were established during February, 1959, have survived and these have demonstrated the ability of lucerne to withstand extremely adverse conditions, once successfully established. The yield from these trials was insufficient to warrant weighing but in older stands fair yields (up to one ton dry matter per acre) were harvested during the season.

(g) Irrigater Pastures

All grass/clover mixtures have been replaced by lucerne. This crop is by far the best winter-green crop tried to date and more information regarding utilization (carrying capacity, fattening ability, etc.) is being sought. At the present time 16 steers are making good weight gains on lucerne derived from 1½ acres of lucerne. In a potash/phosphate/seed rate trial yields of lucerne of up to 14½ tons of dry matter per acre have been achieved. In this trial there is a direct linear response to superphosphate and a quadratic response to muriate of potash where both fertilizers are applied at rates per acre of 200, 800 and 1,400 lb. No advantage has been noted in favour of seed rates greater than 12 lb. per acre. In a "time of planting" trial with oats grown for green feed in rotation with maize for grain (two crops per 12-month period) good yields are being obtained but complete results are not yet available.

(h) Water Relations

In the lysimeter trial only a little water percolated through to the four-foot level in two of the lysimeters. There was no percolation from the remaining ten. Run-off figures in the run-off trial were also low, and only in the case of the bare plots was the amount collected appreciable.

THE SABI VALLEY EXPERIMENT STATION

W. H. WILLIAMS, *Officer-in-Charge*

The Sabi Valley Experiment Station was established during 1950/51 to provide information on the behaviour of crops and soils under irrigation as the first essential step in the proposed large-scale irrigation scheme recommended for the Sabi-Lundi Valleys by the London firm of consulting engineers, Sir Alexander Gibb and Partners.

During the early stages of development, and up to and including the 1957/58 summer season, the work of the Station was confined largely to agronomic investigations, and little time was devoted to water requirements and to the effects of water and crops on soil conditions. Latterly, however, fundamental work of this nature has received increasing attention necessitating much alteration and development, both in the field and in the laboratories, to provide the necessary facilities for research. Investigations of a purely agronomic nature have been curtailed to permit concentration on fewer and more critically designed experiments, and to allow for much closer liaison between sections. Due to the significance of lay-out, and the importance of soil and water management, long-term field-scale trials have become a feature of the work, and due also to the complex and interrelated problems involved, the "team approach" to all investigations has become firmly established.

STATION DEVELOPMENT

A new night-storage dam has been built which allows double the amount of irrigation water, namely, five acre-feet, to be stored, and a more efficient spillway was installed which permits overflow water to pass through the exit-canal Parshall flume and to be measured separately.

A number of small dams have been constructed, utilizing seepage and borrow-pit areas, which will be used for tests on the prevention of seepage using commercial and local clays, bitumastic products and polythene lining materials.

A concrete extraction sump, replacing the temporary mopani-pole structure, has been constructed at the Pumping Station, and allowance will be made for "de-sanding" using a novel water-pressure-jet technique.

Several major improvements have been completed in the irrigation canal systems including the installation of a Flow-Divisor at the Long Plots intersection, which allows the water flow to be split accurately at this point, and additional Parshall flumes (24 in.) have been built into mopani off-take canals permitting more accurate measurement of water to the plots served.

The grade plots (Acacia) and MC plots (Mopani) run-off drains have been lined and methods for collection of run-off waters for analysis are under discussion.

The Animal Husbandry Section completed the fencing of two new paddocks, the use of which will permit those used continuously over the past four years to be rested during the coming season. A good deal of bush clearing and thinning of tree stands, however, remains to be done.

On the advice of the Soil Physicist and to allow water to be applied more efficiently and more uniformly to experimental areas, all plots on the Mopani Farm have been put on grade of 1:500, and all plots on the Acacia Farm, excluding those in the area used for seed increase and non-experimental work, on grade of 1:300. This has proved to be a major operation, and it is now necessary to put in drainage works where possible to make allowance for the run-off of excess surface water.

WEATHER

The yearly total rainfall amounted to 15.58 inches, being substantially lower than the seven-year average of 19.28 inches. Distribution was erratic, the most notable feature being the exceptionally low November and January rainfalls of only 0.84 and 1.17 inches compared with the seven-year averages of 3.38 and 3.31 inches respectively.

The *precipitation deficit* (evaporation less rainfall) for January was 8.7 inches, a four-year average being 4.6 inches; this resulted in a heavy strain on the irrigation programme at critical stages of growth of both cotton and maize crops. The *deficit* for April on the other hand was 5.7 inches compared with the four-year average of 7.0 inches, and as a consequence, planting conditions for wheat, and later for lucerne, were exceptionally favourable.

FIELD CROPS RESEARCH

As a result of the intensification of research effort directed towards obtaining information on water requirements of crops, irrigation methods and the effects of cropping on soil, physical and chemical properties, etc., requiring numerous joint projects by the Agronomy and Laboratory Sections, field crops research as such has of necessity been kept to a minimum during the year under review. Long-term rotation and "structure" trials, however, were continued and certain experiments investigating the use of kraal manure and the effect of previous cropping were repeated. As in previous years a comprehensive series of breeding and selection trials on cotton were conducted as well as detailed studies on, and the control of, the insect pests of cotton. Seed bulking, also, and variety testing of wheat and maize continued, and a sugar-cane nursery and introduction plots of bananas (Gros Michel) and citrus were established.

Detailed results of much of this work are not to hand at this time and only brief notes as follows can be given:

Cotton

Some difficulty was experienced in obtaining good cotton stands during October and November due to lack of rain and the long period of hot, dry weather experienced, but the later planted crops grew out well and some exceptionally high small plot and commercial yields were recorded. Control measures for "stainers" however, did not appear to be particularly effective, which resulted in a high percentage of discoloured lint and consequently lower grades were obtained.

In two small bulk trials, top yields of 5,442 lb. and 5,753 lb. per acre respectively were recorded, while the highest cotton yield so far obtained on the Station, namely 5,815 lb. per acre, was given by material of Albar origin in the Preliminary Variety Trial. In this trial also, the commercial variety, Albar 637, yielded at the rate of 5,566 lb. seed-cotton per acre.

Commercial yields, as reported later, amounted to 3,400 lb. per acre after two years' lucerne, and 2,387 lb. per acre following two years of cash cropping.

Certain American introductions also gave promising yields; bulk plantings of the large-bolled varieties *Arkot* and *Acala* yielded at the rate of 4,728 lb. and 3,877 lb. seed-cotton respectively, while 4,143 lb. and 3,260 lb. per acre were obtained from *Stoneville* and *Acala 1517 BR* on small plots.

Maize

Some exceptionally good yields were obtained from the Variety Trial (Salisbury material) which included two open-pollinated varieties, two single hybrids and eight double hybrids in five replications. Calculations from three replications of this trial indicated yields of 38.7, 29.3, 29.0 and 28.4 bags of grain per acre from 58H3, 51H37, Salisbury hybrid No. 11 and Salisbury hybrid No. 12 respectively, and the highest plot yield of over 40 bags per acre was given by the single hybrid 58H3. It is of interest to note that this material yields reasonably well at Matopos but not elsewhere.

Reasonably good commercial yields of 24.5 bags per acre were reaped from the Acacia Long Plots, while in the Mopani rotation trial, plots in the first and second years of cash cropping following three years' lucerne yielded at the rate of 26.7 and 24.0 bags grain respectively, whereas the continuous grain plots, although heavily fertilized, produced only 17.1 bags grain per acre.

Wheat

A most encouraging wheat season was experienced; quelea damage was light as was the incidence and spread of "rust" (except on susceptible varieties) due possibly to the clear and dry weather which obtained during June, July and August.

Of 24 varieties and selections harvested, 17 yielded at the rate of over 12 bags (200 lb.) grain per acre, and the highest yielding seed-increase plot (1/30 acre) of Gabo origin gave 20.7 bags per acre. The present "commercial" variety, a selection from the Angola strain X-2-50, yielded well especially on the heavier soils (17 bags) but has rather weak straw and is inclined to lodge following the final irrigation. More suitable, high-yielding material to be recommended by the Wheat Breeder, will be used for large-scale plantings next season.

WEED STUDIES AND WEED CONTROL

The dominant species of plants growing under natural conditions in the low-veld are adapted to a limited and seasonal rainfall and the initial population of "weed" seeds of those species likely to present a problem on newly opened lands will be comparatively low. It is most important, therefore, to prevent the introduction and build up of species which thrive on an abundant and regular water supply and to this end it is necessary to use clean seed, well rotted manure and compost, and to carry out continuous weed control to prevent seeding. Canal bank weeds, for example, can be a steady source of supply of weed seeds which are transported and distributed in the irrigation water; successful control has been achieved by spraying with Dalapon or T.C.A.

A herbarium collection has been made of all weed species found on the irrigated lands at the Station, and observations made of the behaviour and control of some of the major species.

Of the broad-leaved weeds, two species of *Amaranthus* and the creeper *Ipomoea sinensis* are particularly troublesome. *Amaranthus* can be controlled by hand and mechanical weeding in summer row-crops and by MCPA in winter cereals. *Ipomoea* may be eradicated by early cutting of lucerne along with aftermath grazing of the lands by dairy cattle and sheep.

The control of grasses in crop lands is more difficult. *Digitaria velutina* may become a problem in old wheat lands and can be controlled by rotational cropping including a lucerne break; *Tragus berteronianus* is a serious weed of newly planted lucerne on lands of poor fertility, and *Eragrostis porosa,* when dominant, would also seem to be an indicator of rather poor soil conditions.

It is believed also that over-irrigation of lucerne during the summer months along with faulty management results in diminishing stands which allow the dominant veld grasses, *Urochloa* and *Panicum* species, to become established. Productivity, however, in terms of animal feed, remains high in summer as both grasses are very palatable and nutritious.

Preliminary experiments on the control of weeds in cotton were conducted by Fisons Pest Control Ltd., and although a certain amount of crop phytotoxicity was manifested in reddening of the leaves when certain chemicals were used, encouraging results in both selective control and total control of weeds were obtained. This important work is to continue.

LABORATORY AND SOIL RESEARCH

Soil Studies

(1) *Methods of Soil Analysis.* Further laboratory tests have been made on methods of measuring soil physical properties. The *macroporosity test* using a tension plate provides a satisfactory assessment of pore size distribution but does not indicate the stability of structural components. *Wet sieving* has been found unsatisfactory due to the extremely rapid dispersion of alluvial soils in water. *Air/water permeability* and *micro-aggregation tests* show promise; both methods are well suited to routine determinations and require no special apparatus.

The commercially obtainable "Speedy Moisture Tester", which employs the evolution of acetylene to measure soil water content, has been tested for three soils of widely differing texture and a final report is awaiting publication.

Some 120 mercury *tensiometers* have been constructed and tested; it would seem that much greater attention must be given to uniformity of installation owing to high "between instrument" variation. A number of non-calibrated *gypsum blocks* are under test in a water status trial.

(2) *Effect of Crops on Soils.* Further analyses of soil samples from the first "Structure" trial have shown that after four years of dhal, the 0 to 12-in depth of soil contained 24 per cent. more organic carbon than after four years of lucerne (poor), maize/wheat or cotton/sunnhemp, but that after two winter and one summer grain crops subsequently grown on and removed from these lands, no differences in the organic contents of the 0 to 12-inch layers were discernible. These crops sequence treatments had no significant effect at any stage on the organic carbon contents of the 12 to 18-inch soil layers.

Results of analyses of soils taken from the Mopani rotation trial have indicated the benefit of lucerne in maintaining soil organic matter status. Continuous cropping with maize and wheat resulted in a carbon content (0 to 6-inch depth) of 0.50 per cent. compared with 0.6 per cent. after three years of lucerne.

Analyses of soils taken at the time of picking from an experiment testing the effect of 10 and 20 tons of kraal manure on *cotton* yields showed that the high application had increased the organic carbon content from 0.34 per cent. to 0.49 per cent.; this was associated with a yield increase from *2,831 lb.* to *3,571 lb.* per acre of seed-cotton.

The above results indicate that an important requirement of a rotation is the maintenance of soil organic matter.

(3) *Effect of Passage of Irrigation Water through Top Soil:*

(a) *The Leaching of Nitrogenous Fertilizer.* Laboratory leaching tests on a six-inch depth of Acacia top soil treated with *urea* and with *ammonium sulphate* at the equivalent rate of 60 lb. N per acre and applying a four-inch depth of water have been made. About 50 per cent. of the applied water was collected as leachate; that from the urea-treated soil contained 70 per cent. of the nitrogen added as fertilizer whereas that from the ammonium sulphate soil contained only 0.4 per cent. The amounts of soil collected were 300 and 110 mg. respectively. It appears that the use of *urea* on light textured soils is likely to result in a considerable leaching of nitrogen if the fertilizer application is immediately followed by a heavy irrigation.

(b) *The Effect of Addition of Gypsum on Soil Movement during Irrigation.* In laboratory tests, distilled water leached 287 mg. of soil from 2,700 gm. soil samples compared with 183 mg. leached when Sabi river water was used. When the equivalent of 150 lb. per acre of gypsum was dissolved in the irrigation water the amount of soil collected was 27 mg., and when finely divided gypsum at the same rate was added to the soil surface and leached, 56 mg. of soil were collected. It is possible, therefore, that the addition of small quantities of gypsum to the comparatively pure Sabi river water would improve its quality for irrigation purposes.

(4) *Fertilizer and Soil Amendment Studies:*

(a) *Effect of Sources of Nitrogen.* Since 1956/57, six nitrogen sources have been applied to plots cropped to maize, wheat and barley. Significant differences in yield were obtained only with the first two maize crops. With the first—ammonium sulphate, nitrolime, sodium nitrate and urea all gave greater yields of grain than ammonium nitrate or kraal manure plus urea. With the second—kraal manure plus urea showed an improvement over ammonium nitrate, sodium nitrate and urea, and ammonium sulphate gave a better yield than sodium nitrate. No significant difference was obtained between ammonium sulphate and urea.

Saturated past pH measurements on 0 to 6-inch soil samples taken at the commencement of the experiment and after six crops had received differential treatments, showed mean reductions of 0.62, 0.43, 0.05, 0.08 and 0.35 units for ammonium sulphate, ammonium nitrate, sodium nitrate, nitrolime and urea respectively, whereas the application of kraal manure plus urea resulted in a rise of 0.31 pH units. The application of ammonium sulphate over four years to Acacia soil at the rate of ± 500 lb. per annum reduced the pH from 6.82 to a mean value of 6.20.

The response of *maize* to ammonium sulphate, urea and urea-form was tested using 90 lb. per acre *N* as a planting dressing. *Urea-form* gave no response over control (14 bags per acre) whereas ammonium sulphate and urea applications resulted in 19 and 17 bags of grain per acre respectively.

To test residual effects of these nitrogen carriers, wheat was grown after maize without further addition of fertilizers. No significant differences were recorded in fresh green weights of wheat harvested.

(b) *Effect of Sulphur Additions to Lucerne.* On Acacia type soil, significantly higher yields of lucerne have been obtained when sulphur was applied before planting either as calcium or magnesium sulphate. The mean yield over six cuts was increased from 1,200 lb. to 1,840 lb. air-dry lucerne per cut by the addition of sulphate sulphur.

In a later comparison trial, elemental sulphur and sulphate sulphur were applied in a number of combinations with calcium and phosphorus carriers. For one cut, treatments containing sulphur gave 47 per cent. higher yields over those without sulphur.

WATER AND IRRIGATION STUDIES

(1) *Irrigation Efficiency Studies on Experimental-scale Plots:*

(a) *Water distribution* has been found to be far from uniform on experimental-scale plots using surface methods, and both Acacia and Mopani Farm plots have now been put on grade (1:300 and 1:500 respectively) to encourage more rapid movement of the water during irrigations and to prevent standing water after heavy rain. These grades, however, introduce the problem of under-irrigation at the canal end under certain circumstances; this has been observed in newly planted lucerne on Mopani soil and in ridge-planted maize and cotton. Non-uniform distribution of water also may account for marked yield differences within plots. For example, in a wheat uniformity trial (Mopani soil, 1:500 grade), 10.6 bags per acre were recorded at 30 to 45 feet from the canal and 13.3 bags at 75 to 90 feet.

In a similar experiment on Acacia soil on the other hand, wheat yields were remarkably uniform, the variation in yield at four positions down the plots being less than three per cent. of the mean yield.

(b) The effect of *application flow rate* on the total water applied to experimental-scale plots has been tested for wheat. On Mopani class A soil (110 ft. long plots) total applications in seven irrigations were 16.0, 12.5 and 11.6 inches for 2.0, 1.0 and 0.5 cusecs per 15 ft. wetted width of plot, and on Acacia class A soils (138 ft. long plots), the total applications were 17.9, 16.0 and 18.0 inches for the same flow rates.

(2) *Irrigation Efficiency Studies on Farm-scale Plots.* Attention has been confined to 390 ft. and 800 ft. long plots on Acacia class A soil and to 500 ft. long plots on Mopani class C soil. The total quantity of water applied, the run-off and the water contact time for different positions down the plots have been recorded, and in all cases crop yields were measured in 30 or 50 ft. intervals from the canal.

(a) *Effect of Grade on Irrigation Efficiency on 390 ft. long Plots—Class A Soil. Maize* grown on 1:500, 1:350 and 1:200 grades received 26.1, 21.5 and 15.2 inches of water in seven, eight and nine irrigations, the mean application per irrigation being 3.7, 2.7 and 1.7 inches, and the mean yields 19.8, 26.2 and 21.7 bags per acre grain respectively. Highest yields were obtained in the region 180-240 ft. from the canal where up to 30.9 bags per acre were recorded on 1:350 grade plots.

Land preparation irrigation for *wheat* required eight inches on 1:500 grade and four inches on 1:200 grade. *Wheat* received six irrigations with a total of 30.3, 27.1 and 20.4 inches of water on 1:500, 1:350 and 1:200 grades respectively.

Hand made *corrugations* between 14-inch wheat rows reduced the overall mean application from 29.4 to 22.5 inches. Reducing the application flow rate from three to 1.5 cusecs increased the total application on 1:500 grade corrugated plots from 23 to 30 inches, and on 1:200 grade from 15 to 21 inches, but did not affect applications required on the 1:350 grade plots. *Wheat* yields followed the same pattern as for maize, namely 10.5, 14.8 and 13.1 bags per acre on 1:500, 1:530 and 1:200 grades respectively.

(b) *Effect of Flow Rate on Irrigation Efficiency on 800 ft. long Plots—Class A soil. Cotton* was irrigated with 0.2 and 0.1 cusecs per ft. flow applications (six and three cusecs per 30 ft. border) using alternate flow rates on two plots. The mean application per irrigation for eight irrigations (excluding the planting irrigation) using the two flow rates was 2.98 and 2.36 inches respectively, the average total amount of water applied to the two plots being 25.4 inches. Yields were very uniform down each plot but differed markedly between plots; for example *cotton* after two years' lucerne yielded 3,400 lb. per acre and after two years' cash cropping, 2,387 lb. per acre.

Maize was irrigated in the same way, the mean total application including land preparation for the following crop, being 34 inches and the mean yield, 24.3 bags per acre; means of eight irrigations at 0.2 and 0.1 cusecs per foot were 3.8 and 3.7 inches per application respectively when planting applications were excluded.

 Wheat (14-in. rows) was irrigated with and without corrugations which were made by hand after the initial irrigation. Mean applications per irrigation for five irrigations were 4.34 and 5.21 inches respectively. However, the run-off was much greater using corrugations and the mean amounts retained on the plots per irrigation were 4.03 and 4.32 inches. Mean *wheat* yields of 10.7 and 9.5 bags per acre respectively were recorded.

(c) *Effect of Flow Rate on Irrigation Efficiency on 500 ft. long Plots—Class C Soil, 1:500 grade.* Flow rates of 0.1 and 0.03 cusecs per wetted foot (1.5 and 0.5 cusecs) were alternated on four plots each of *cotton* and *maize*, applying 2.15 and 1.88 inches to maize and 3.03 and 2.47 inches to cotton per irrigation respectively. Maize received a mean total of 23.5 inches of water in 11 irrigations and cotton, 26.5 inches in nine irrigations.

Yield distribution of both maize and cotton was by no means uniform within the plots on this soil type; maize grain averaged 19.4 bags per acre but for successive 100 ft. sections from the canal, 29.0, 23.2, 19.3, 15.1 and 10.5 bags were recorded. Similarly the yield of seed-cotton at 50 to 100 ft. from the canal was 3,483 lb. per acre and 2,324 lb. per acre at 400 to 450 feet, with a mean yield per plot of 2,876 lb. per acre from one picking. *Wheat* also was grown on this soil type with total applications of 25.6 and 29.2 inches of water when flow rates of 0.1 cusecs and 0.017 cusecs per wetted foot were used, and yielded at the rate of 17.2 and 15.7 bags of grain per acre respectively.

(3) *Soil Water Status and Crop Production.*

(a) *Cotton.* Irrigation when the soil water suction rose to approximately 0.5, 1.0, 4.0 and 15.0 atmospheres at 9-inch depth gave yields of 4,283, 4,145, 3,590 and 3,135 lb. per acre seed-cotton with 26.6, 17.5, 16.4 and 10.8 inches total applications in 14, 8, 6 and 4 irrigations respectively. With an early dry period followed by irrigation at 0.5 and 1.0 atmospheres suction the yield was 3,903 and 3,985 lb. per acre with 21.5 and 14.7 inches total application in 10 and 6 applications.

Fertilizer *N* had little or no effect on yield of seed-cotton in this trial.

(b) A very marked response was obtained with *maize* to irrigations at 0.5 atmosphere soil water suction at 9-inch depth, 28.6 bags per acre being recorded compared with 23.9, 18.8 and 20.0 bags with irrigations at 1.0, 4.0 and 15.0 atmospheres respectively. Uniform irrigations were applied until tasselling which accounts for the comparatively good yields obtained from the dry treatments. Again as with cotton, no response was observed when nitrogen applications were increased from 40 lb. per acre to 60 and 120 lb. per acre.

CONSUMPTIVE USE OF WATER BY CROPS

Direct soil sampling and determination of changes in total water content have been used to estimate consumptive use of water by a number of crops. Results have been compared with evaporation over the same time intervals, and ET/EO ratios have been presented graphically for the cropping seasons. The ratio is markedly affected by rain or irrigation even if deep penetration does not occur. Fully grown maize gave ET/EO (Australian pan) ratios of approximately 0.7 during rainless weather. When rain occurred the ratio rose to about 0.95 Also, in the 0 to 72-inch soil sampling zone, 75 per cent. of the water withdrawn by mature maize occurred in the 0 to 30-inch layer.

Wheat irrigated at a suction of 0.5 atmospheres at 9 inches between 14-inch rows, showed an ET/EO (class A) ratio of about 0.9 when full ground cover was obtained. Owing to the shallow root system of this crop, irrigations were applied at approximately two-weekly intervals.

Since good correlations have been found between evaporation from atometers and evaporation pans, preliminary values for ET/Ex (Piche) have been calculated.

As a guide to irrigation need for general experiments, a *soil water deficit indicator* has been constructed and used during the year, and in order to ensure that water deficiency in no way limits plant development, a value of unity for

ET/EO (class A) has been assumed for all crops which fully cover the ground. Use of this indicator has greatly simplified the control of irrigations to all plots other than those in water status experiments.

AGRO-METEOROLOGY

A full range of instruments is now installed at the Agro-Meteorological Station. For all available data, monthly means have been tabulated from October, 1953, to date. Weekly means have been calculated and tabulated from January, 1957, to date, and average monthly means for seven years' data have also been calculated.

The average monthly precipitation deficit [EO (Australian)—rainfall] has been calculated from four years' data. An interesting bimodal distribution was obtained with maxima of 10 and 7 inches per month in October and April and minima of 3.5 and 4.5 inches per month in December and June respectively.

Numerous comparisons of water losses from evaporimeters have been made. For 67 consecutive weekly periods the evaporation from an unpainted class A pan showed a correlation of $r=0.929$ with that from a Piche atometer. For 33 rainless weeks the correlation coefficient increased to $r=0.976$.

The Gunn-Bellani radiation integrator has given a very close correlation with evaporation from the unpainted class A pan ($r=0.962$) for 39 weeks.

Meteorological data for several years have been despatched to E.A.A.F.R.O. at Nairobi for analysis, with particular reference to the use of the Penman equation for calculation of evaporation.

GENERAL

External Work. A considerable amount of work on soil and irrigation problems has been carried out on the Sabi Valley Development Farm at the request of the Department of Conservation and Extension and a report on this work has been recently completed.

At the request also of the Native Agricultural Department, soil physical determinations have been undertaken on samples from Chisumbanje, Chibuwe and Nyanyadzi, and visits by Station Staff have been made to these projects to advise on irrigation problems. The liaison has made it clear that these physical problems are basically similar under European and African irrigated agriculture and that there would appear to be no justification for any separation of effort in solving them.

STAFF

Major staff changes have taken place during the year under review and further staff replacements will be required in the near future.

Mr. F. D. Elias, Technical Assistant (Agronomy), was transferred in March to the Melsetter Pasture Research Station. In lieu of this post it was agreed by internal arrangement that an Agronomist (P.O.) be appointed; great difficulty has been experienced in obtaining suitable candidates, however, and the post remains unfilled.

The Senior Agronomist, Mr. P. D. Waister, resigned in July to return to the United Kingdom for further study; this post has been filled by Mr. K. E. Cackett, transferred on promotion from Matopos Research Station.

The Soil Physicist, Mr. B. D. Soane, returned to the Chemistry Branch, Salisbury, at the end of September, after completing a two and a half year tour of duty in the Sabi; his place has been taken by Mr. H. R. R. Metelerkamp, on secondment from the Chemistry Branch.

The Farm Manager, Mr. B. Macvicar, leaves shortly to take up a post with Native Agriculture; he will be replaced by Mr. J. S. H. Steyn.

Mr. P. S. Jackson, Technical Assistant (Agronomy), has resigned as from the end of December, to take a teaching course at Bulawayo; steps have not yet been taken to fill this post.

GWEBI AGRICULTURAL COLLEGE

DR. W. L. FIELDING, *Principal*

INTRODUCTION

Gwebi Agricultural College was officially opened on 15th February, 1950, so that 1960 has seen the end of a decade in the life of the College, and students of Course 10 completed their training in July.

The College year under review commenced on 1st October, and Diploma Day was held on 14th October, 1959, when the Rt. Hon. Sir Robert Tredgold, K.C.M.G., Chief Justice of the Federation of Rhodesia and Nyasaland and, at that time, Acting Governor-General, was the Guest of Honour. Lady Tredgold presented the Diplomas to Course 9, and the trophies and prizes to Courses 9 and 10.

Last year it was reported that despite the fact that a 50 per cent. expansion of the College took place in 1954, the number of suitably qualified applicants for entry had tended, once again, to exceed the capacity of the College. However, when the final selections for Course 12, due to commence in October, 1960, were made, it was found that only a very few suitably qualified men would be held over to 1961, as many applicants withdrew for various reasons. Nearer the commencement of the course, some of those originally offered places withdrew, their places were taken by men whose entry was initially deferred, and in the end the very small number of deferments proved of no consequence. The postion was certainly not such as to warrant a recommendation that Government provide funds for a further stage of expansion.

Now, at the conclusion of the 1959/60 College year, there would again appear to be increased pressure for entry, and the figures are quoted below. Two factors have almost cetrainly influenced the number of applicants with satisfactory qualifications, or with a strong likelihood of qualifying. These are, firstly, a greater awareness on the part of secondary schools, parents and applicants, of the necessity to qualify in subjects prescribed; secondly, the raising of university entry standards, and the bottleneck in sixth form facilities at secondary schools, allowing only the top boys to qualify for university. How far the figures indicate a *real* increase in the interest of young men in farming remains to be seen, and also, of course, how many will remain firm applicants when final selection time comes.

APPLICATIONS FOR 1961

Already qualified academically and now obtaining further Credits or doing practical farming	Likely to qualify academically (Headmasters' interim report)	Doubtful	Unknown, i.e., no report yet obtained from School
36	31	12	15

Detailed expansion plans have been worked out, in case of need, and submitted to the Ministry. It has been agreed, and publicly announced, that Gwebi College caters for Europeans, Asian and Coloured male students. The year under review marks the first occasion in which the list of applicants likely to qualify for entry includes the name of a non-European—in this case an Indian. It is of interest to record that of the three Portuguese students from Moçambique, who have attended the College in recent years and have fitted well into the community, two obtained the College Diploma, one of them First Class.

There has been speculation and inquiry recently regarding the post-College careers followed by Gwebi students. Consequently, a questionnaire was sent to all students who had obtained the Gwebi Diploma up to August, 1958. This questionnaire included a request for information on the following points:

(i) Present occupation.

(ii) Notes on post-Gwebi employment.

(iii) Whether the old students' present emoluments and ultimate financial prospects are considered adequate recompense for the money and time expended in training.

(iv) Whether or not the old student intends to stay in farming.

Sixty-five per cent. of the students to whom the questionnaire was posted have replied; a percentage considered by the Central African Statistical Office to be a satisfactory sample. The analysis of the replies has revealed the following:

	Per cent.
Farming on their own account	30.5
Employed on farms	46.5
Employed in Government agriculture departments	12.0
Employed in other agricultural work	5.5
Employed in essentially non-agricultural work ...	5.5

The breakdown of the 30.5 per cent. farming on their own account gives the following figures:

	Per cent.
On farms which have been family property or on farms where land and capital have been obtained through parents	27.0
On Crown land farms with financial assistance from parents for development	3.0
On a farm, having received financial assistance from a benefactor	0.5

Thus, whilst the majority of old students are engaged in farming pursuits, apparently not one has set up on his own through savings obtained from employment as a farm manager or assistant. This information supports recent contentions by the "Gwebians" (Old Students' Association), who appointed a sub-committee some time ago to approach the Rhodesia National Farmers' Union, the Government, and other national organizations, with a view to bringing into being a tenant farming scheme on a national basis.

Although the general work of the College remains mainly educational, some useful research has continued in the various sections, and this is described below.

EDUCATION

Twenty-nine students of Course 10 sat the final examinations in July, 1959. Twenty-five students obtained the Gwebi Diploma, nine of these being First Class. There were many Distinctions, and two students obtained Distinctions in the three major subjects of Field Husbandry, Animal Husbandry, and Engineering and Building Construction, as well as in practical work. For the first time in the history of the College, all 36 First Year students (Course 11) stayed out the complete year and sat the final First Year examinations; there is usually a degree of wastage, during the year, for private and other reasons. Of the 36 finalists, 32 qualified, making Course 11 the largest Second Year Course in Gwebi's history.

For many years the College has depended on cyclostyled notes as a "Prospectus". In 1959, however, the Government Printer, Salisbury, was able to print an illustrated prospectus, including full details of the syllabus covered in lectures, demonstrations and practical work. This is now available for posting to potential students and organizations interested in the College. Copies of *Gwebi Echoes,* the now well-established, annually produced student magazine, are frequently sent out along with the prospectus, providing an up-to-date account of general student activities.

Outdoor-teaching, in the form of day visits to farms and research stations, and organized tours lasting several days, continues as a most important educational activity, and even tends to grow in importance. This year the *Short Tour* embraced a study of the work being done by the Department of Conservation and Extension, in co-operation with farmers, in the Sabi catchment area. The *Long Tour* took the students southwards, through ranches, forest work, and the Native Agriculture Department's experimental station at Makaholi; to the Kyle Dam, and down into the lowveld to observe the canal and irrigation potential of the south-eastern portion of the country, ending with the study of a lowveld ranch, where an old student is ranching with his father. Rhodesia's agricultural shows fall mainly in the college long vacation, but students who volunteer to prepare and show College livestock during this time learn a lot.

DEVELOPMENT

For the first time since 1954/55, the College has seen a definite and very worthwhile development with the provision of funds on the Vote to construct tobacco barns and a bulking and grading shed. The details of this development are referred to under the sub-heads, Education, Field Husbandry and Engineering and Building Construction, below.

EDUCATION

The *teaching farm* on which the College is based has, up to now, concentrated on the production of food of plant and animal origin. Although there is no true sandveld, there is an area of the farm which has been set aside for many years for possible tobacco growing. There has been a resistance by parts of the Rhodesian farming world, to the idea of teaching practical tobacco growing at Gwebi. These people seem to have feared the disruption of Gwebi's avowed policy of giving young farmers a sound background in the *general principles* of mixed farming. A memorandum was produced by the lecturer in Crop Husbandry showing that tobacco would not interfere in any way with the general nature of practical work at Gwebi, and this, together with a visit of a Rhodesian Tobacco Association sub-committee to Gwebi for talks with the principal and staff, finally convinced them that their fears were groundless.

The coming College year will therefore see the integration of practical tobacco instruction in the Field Husbandry syllabus—this making a satisfactory complement to the comprehensive series of lectures on tobacco culture which have been part of the curriculum for some years.

Actually, a great all-round improvement in field practice is expected through the following new arrangements, particularly at those times of year when lack of rain delays planting operations, or during the period when food crops are growing and needing little attention.

October.—Holding over some of the maize crop for shelling; watering-in of potatoes (proved as a practice by experiments at Gwebi); tobacco planting with water.

Mid-December.—Topping and suckering tobacco.

January.—Half field practical time on reaping and curing tobacco (night barn duties, by roster, commence).

February.—Ditto.

May.—Grading of tobacco.

June.—Limited amount of time to be devoted to finishing off grading.

A general improvement in practical field instruction has been brought about by making the tasks set to students more nearly equivalent to those set to the labourers; this development has meant longer hours for the Field Instructors, and additional work for the matrons in providing staggered mealtimes at the hostel.

FIELD HUSBANDRY

The main development has been the preparation for tobacco planting, of a field formerly called Camp 6, and now to be renamed *Tobacco Land*. About forty acres in extent, it is situated on the east of the road, a few hundred yards north of the College main entrance. The soil here can be described as a pinky-grey, clay loam; the *Msasa* trees have been stumped out over a period of years, and the natural veld grazing has been lightly used for three or four years. The land has been used for overwintering of the Hereford herd and Friesland herd followers, these animals being fed silage and legume hay in one corner of the field, but with the animals roaming freely over the area. The field is divided into four ten-acre strips, one of which will be planted to tobacco each year. In view of the history just described, the nitrogen factor will possibly be problematical until the last of the four ten-acre strips has been down to tobacco. Each tobacco crop will be followed by planted grass, and each ten-acre strip will therefore carry tobacco once in four years, so that even if nitrogen is a problem initially, this factor should become less difficult to control later on.

From the point of view of student instruction, of course, the more difficulties there are, the more valuable will be the experience.

Officers from the Department of Conservation and Extension, Chemistry Branch, Kutsaga, and local farmers, have been freely consulted and have willingly given their advice.

ANIMAL HUSBANDRY

There have been no developments in the Animal Husbandry Section, including the Poultry Plant.

ENGINEERING AND BUILDING CONSTRUCTION

A major development has been the replanning of the syllabus, making *Field Engineering* a more definite part of engineering; some aspects of conservation, farm planning, and irrigation, previously taught and examined within the framework of Field Husbandry (as a major subject), will now come under the aegis of Agricultural Engineering.

Two further blocks of semi-detached housing were constructed in the African village, this work absorbing most of the funds available to purchase materials for practical building instruction of students.

Work continued on the sports pavilion at the College playing field. The materials are purchased from the College General Purposes Fund Account, and not from Votes, but the students have taken part in the building, gaining valuable practical experience.

A considerable amount of time went into planning the tobacco barns, bulking and grading shed. The building of these was commenced in July, 1960, the site being on the west side of Tobacco Land, consideration having been given to time and motion problems in reaping and adequate distance from the seed-bed site (on the west of the playing field). There are four barns, 12 ft. x 18 ft., of normal height, and with different types and makes of curing equipment, to give variety of experience. The teaching aspect has received due attention in the design, particularly where adequate room for practical work groups in the grading shed is concerned.

ESTATE

The planting of flowering trees and shrubs continued.

GENERAL

A most useful development for the College as a whole has been the establishment of a second order Meteorological Station at the College.

PRODUCTION

Total rainfall was well below average, being 24.0 inches compared with a 47-year mean of 32.5 inches. Further weather details are given under Research heading below, but from the general production viewpoint it must be noted that during November, 1959, a total of only 1.54 inches fell (compared with an average for the previous four years of 4.32 inches), individual falls being too small to assist in tilth formation. The picture in December was similar until the 21st, when 0.82 inches fell. Between 20th and 31st December, 4.24 inches fell, making the main planting rains over a month late. Rhodesian meteorological authorities say that there is an 80 per cent. probability of planting rains falling before 25th November in this area.

Field production included:

Crop	Acres	Production	Yield per Acre
Maize grain (Broadbalk) . .	65·5	775·0 bags	11·80 bags
Maize grain (Gwebi South) . .	179·0	1,693·0 bags	9·50 bags
Maize silage	44·0	724·0 tons	16·40 tons
Sunflower (seed)	15·0	31·0 bags	2·00 bags
Groundnuts (unshelled) . . .	9·0	85·0 bags	9·40 bags
Potatoes	8·8	328·0 bags	37·50 bags
Velvet beans	8·0	8·5 bags	1·00 bags
Natal sugar beans	7·3	23·0 bags	3·20 bags
Soya bean hay (est.)	60·0	80·0 tons	1·25 tons
Sunnhemp hay (est.)	18·0	20·0 tons	1·25 tons
Legume silage (est.)	34·0	141·0 tons	4·10 tons
Sudan grass silage (est.) . . .	35·0	150·0 tons	4·30 tons

The following points are worthy of note. The general maize yield dropped sharply with the poor season. Included in the Gwebi South figure of 179 acres were 50 acres of *continuous maize* on Lilford North; this land, now in its fourth year of mono-culture, dropped to six bags per acre compared with 18 bags per acre last year, possibly an interaction between mono-cultural conditions and a very unfavourable season. Compared with the maize grain yield, maize silage, at 16.4 tons per acre, was well up to standard, not being affected by the late planting in the same way as maize grain.

The Friesland Dairy herd has not exhibited any recurrence of the diseases that have affected it in the past. A pregnancy test made towards the end of the period under review showed that 32 out of the 34 animals tested were in calf, the two failures being young heifers recently bulled for the first time. The overall herd average was maintained at just under 1,000 gallons of milk per cow per lactation, with butterfat in the region of 3.6 per cent. Methylene blue was maintained above the required level throughout the year.

In the pedigree Hereford herd the first calf crop by the imported English bull, *Wetmore News*, began dropping in August, 1959. Twenty-two calves were born, one of which was still-born, giving a 90 per cent. calving percentage. The calves have proved to be of good quality, and remarkable uniformity, holding great promise for the future of the herd. From a pregnancy test made towards the end of the period under review, it seems that another 90 per cent. calving rate can be expected.

College pigs continue to give satisfactory results at the Litter-testing Station.

The total number of hens housed in the College Poultry Plant was higher than in the past, bringing egg production up to 21,779 dozen eggs for the period, this being 8,000 dozen higher than in any previous year. This practically supplies the requirements of Salisbury's three central hospitals, and sometimes surplus eggs are available for Harari Hospital, too.

RESEARCH

Whilst education will always remain Gwebi's major task, it is essential for staff to have some facilities for research, and it is advisable for the young farmer to have had some contact with the methods and problems of research whilst at College.

FIELD HUSBANDRY

THE WEATHER: RAINFALL AND TEMPERATURES, 1959/60 SEASON

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	TOTAL
Inches rain . . .	—	—	0·05	1·17	1·94	5·15	3·08	4·69	0·96	4·09	1·91	0·96	24·00
Rainy days . . .	—	—	1	5	7	14	12	12	6	6	3	8	74
Days over ½ in. rain	—	—	—	2	4	5	4	7	1	3	2	1	29
Mean max. temp. .	71·3	74·5	80·6	86·1	84·1	80·5	81·8	78·7	79·5	78·0	73·2	68·6	—
Mean min. temp. .	45·0	44·3	48·3	55·2	58·0	62·3	58·1	59·2	54·8	51·2	45·6	44·8	—
Mean temp. . .	58·2	59·4	64·4	70·6	71·0	71·4	70·0	69·0	67·2	64·6	59·4	56·7	—

Maize Varieties. No. 58 H 1 again produced significantly higher yields of grain (21.5 bags per acre) and plant material than any other hybrid or variety, thus confirming the previous season's result. This is particularly noteworthy as the two seasons have differed so considerably in weather conditions. S.R. Hybrid No. 12 has out-yielded all the other *commercial* hybrids by a significant amount, both as a grain and silage producer, a remarkable result in such a season, seeing that it is a later maturing type. The open pollinated varieties again performed very badly.

Nitrogen and the Maize Plant. Studies on this subject continue, together with investigation of various interactions, such as times of ploughing and planting, plant populations, with nitrogen and so on. The maize crops used for this work follow various crops and soil treatments, including a managed and fertilized grass ley. Results indicated that early ploughing is better than late, and that it is preferable to apply high dressings of nitrogen at one time, than at different times. The cumulative effect of the various treatments on soil nutrient status, pH and organic matter content will be measured in certain cases. It is hoped that a comprehensive account of "Nitrogen and the Maize Plant at Gwebi" will soon be prepared.

Summer Potatoes. For some years the incidence of late blight *(Phytopthera infestans)* has been a serious limiting factor to potato production in Mashonaland. The most important factor determining a blight attack is the weather, and in particular the degree and duration of high humidity. In any season a blight period will occur at a given time; thus the earlier the potatoes are planted before this period the higher is the expected yield, other things being equal. Normally the farmer is limited to planting when the first heavy rains fall. The Tobacco Research Board has shown that Virginia flue-cured tobacco can be successfully established before the rains with a limited amount of water, and this practice is now becoming common on Rhodesian farms. Following up the supposition that this technique might also be successful with potatoes (which are hardier than tobacco seedlings) experiments were carried out at Gwebi, with watering, giving an artificial extension to the period from planting to 75 per cent, blight conditions. The first experiments indicated that whilst the more conventional work on potato varieties, spacings, fertilizers, organic manures and sprays, is yielding results of importance, this new approach was certainly worth following up, particularly in view of the fact that considerable development of water-carting and water-application equipment has taken place for tobacco, and the same type of equipment could be used for potatoes.

Soya Beans. The main line of work is the selection of later maturing types than at present available, for forage production. Two strains, selected from material obtained from the Sudan, Tanganyika and the United States, took 14 to 21 days longer to reach the hay stage than H147, the best Rhodesian strain, and appeared vigorous. Work on these and other material will continue.

Pastures. The Fertilizer Grazing Trial, commenced on top-land veld in 1953/54, was terminated this season and a final botanical analysis carried out. The results are being written up fully, for publication, but briefly they show that the application of fertilizers to veld will give increased live-weight gains of beef cattle, but that the increase is not sufficient to be economic with the present price of fertilizers. Interesting botanical changes were brought about by fertilizer application, notably the tremendous increase of *Sporobolus pyramidalis* with a high level of nitrogen.

Two new research projects were initiated, with the object of providing comparative information on yield of dry matter and protein, longevity and ley effect (carbon and nitrogen build up) of some fifty grasses and cereals.

Animal Husbandry

Field and Animal Husbandry staffs have co-operated in animal feeding trials, which are designed to study economy in beef and milk production.

Steer Feeding Trial No. 3. This trial, composed of Mashona, Hereford, Tuli, and Sussex cattle, was completed in October, 1959. The object was to produce good quality young beef more economically than in the first two trials, and to study such breed differences as might arise. Costings are difficult at a college, because of the varying personnel handling any project, and the difficulty of accurately assessing overheads, but it seems fairly certain that basic winter management using grass hay, urea and molasses, holds useful possibilities of converting possible losses into profits. It is thought that the profit margin is still too low and efforts will be made to improve things further with trial No. 4. A statistical analysis of the data showed no breed differences; there have been greater differences within than between breeds in the three trials so far concluded.

Steer Feeding Trial No. 4. This trial, including Inkone, Africander, Aberdeen Angus and Tuli cattle, commenced in July, 1959. During the summer grazing season under review, the steers averaged a live-weight gain of 216 lb., the general level expected on the College farm, and then went on to a hay alone and, later, hay plus urea feed. At the conclusion of this trial a general account of all four trials will be compiled.

Legume Silage as a Protein Supplement for Dairy Cows. This experiment was designed to determine the extent to which legume silage can replace purchased high protein feeds, such as groundnut meal, in the winter rations for lactating dairy cows, particularly in view of the recent considerable rise in the cost of groundnut meal. The experiment was designed to give critical results; it has only just concluded and the results will be written up after analysis of the data.

Poultry. The long-term project of producing hybrids continued successfully, and this year the College has brother and sister mated in some families for the fifth generation. An innovation was the use of the services of a chicken sexer, to eliminate cockerels at day old, to prevent wasting food on birds not required for breeding.

ENGINEERING

The limited staff of the Engineering Section has militated against the development of research, but valuable testing of a few pieces of equipment has been carried out for various manufacturers.

AGRICULTURAL SHOWS

An excellent model of the College depicting the College farm and buildings was made by staff and students, forming the central part of the College stand at the Salisbury Show. The College exhibited a considerable string of livestock at the Umtali (50th) Show, and the Salisbury Show, winning many awards, particularly with Hereford breeding stock and fat-stock. A feature of this work was the presence of students who volunteered to prepare and show the animals in the College long vacation.

TRAVEL

It is often said that the College staff should travel more widely, for the benefit of teaching, and that this travel should not be confined to accompanying students on tours and visits to research stations, and so on. The development of this aspect could only take place satisfactorily with an enlarged staff, giving greater leeway in permitting staff to be away without jeopardizing student education, and with more funds available for subsistence and travelling and mileage. As things are, it is difficult enough to make provision for normal vacation and sick leave, apart from travel for educational and broadening reasons.

However, in the year under review, the Senior Lecturer in Agricultural Engineering went at Government expense to see machinery testing and other work in East Africa, for a brief period of three weeks; also the Senior Lecturer in Animal Husbandry judged at the Rand Spring Show, visited Friesland herds in the Union to buy bulls for Gwebi and Grasslands, but not at Government expense.

TOTAL REVENUE

During the financial year ending on the 30th June, 1960, revenue from all sources at the College, including student fees, was £31,000.

CHIBERO AGRICULTURAL COLLEGE

J. W. WALSH, Principal

STAFF

The Principal of the College was appointed as from the 1st January, 1960, and therefore this report will only cover, in the main, the nine months to the 30th September, 1960. The Principal took up residence at the College, in temporary accommodation, on the 26th February, 1960.

A Technical Assistant, Mr. J. Gibbons, to help with the initial College farm development, took up duty on the 29th February, 1960, and has been resident at the College since that date.

A Clerical Officer, Mr. W. F. Hayman, joined the College Staff, on transfer from the Federal Treasury, on the 1st April, 1960. Because of the long, protracted negotiations in regard to the establishment of bachelor quarters at the College, Mr. Hayman continues to occupy an office at the Ministry's headquarters in Salisbury.

A Professional Officer, Dr. J. N. Clatworthy, took up duty on the 1st July, 1960, the day from which the post became established. Although a bachelor, he has willingly resided at the College since his appointment, pending the establishment of bachelor quarters.

The post of Building Operator (Grade V, Branch IV) exists on the present College establishment but has not yet been filled.

The College Advisory Council has recommended the establishment of two Professional posts and two Technical Assistant posts as from the 1st January, 1961. It can now be stated with confidence that these posts will be absolutely essential if there is to be any hope of being ready for the opening of the College in October, 1961.

An attempt was recently made to solve the problem of typing at the College. It seems likely that a Clerk/Typist post would be graded Scale E of Branch III, the salary scale being £315 to £472 10s. per annum. When it is remembered that the status of the incumbent of this staff position will be that of an officer occupying a house the rent of which will not be less than £6 per month, with electricity at not less than £4 per month, one is reliably informed that such a salary will fail hopelessly to compete with the remuneration offered in commercial and industrial spheres for such qualified people. It would appear that a more realistic approach into the problems of staffing Government multi-racial establishments is urgently required. In the case of this College, time is *not* on our side in regard to this problem.

THE COLLEGE ADVISORY COUNCIL

Two full meetings of the College Council and one meeting of a Council sub-committee were held during the year. The second full Council meeting included a visit to the College on the 15th September, 1960. Minutes of the Council meetings contain recommendations to the Minister of Agriculture.

BUILDING DEVELOPMENT AND PROGRESS

Prior to the year under review the Department of Irrigation put down a borehole, and work then began on fittting it and installing a water reticulation scheme, including a 20,000 gallon tank on a 25 ft. metal stand. By October, 1959, the Department of Engineering and Construction arrived at the site of the College and work commenced on eight instructor houses and 40 semi-detached houses for African employees. Subsequently, four contractors arrived to (a) install an electrical reticulation; (b) build eight houses for the professional staff, including the Principal's house; (c) build the College tutorial, administrative and hostel blocks, and (d) construct a road layout to give access within the residential and campus area. By the close of the year very considerable progress with all these contracts had been made. It is anticipated that this whole programme will be completed by the end of 1960. Progress can be considered as satisfactory.

It should be mentioned that the workmanship of the Department of Engineering and Construction leaves much to be desired.

A certain amount of building material, e.g., 50,000 bricks, was stock-piled in preparation for the development of farm buildings.

FARM DEVELOPMENT

A tentative Farm Plan, based on a recent reclassification of the land capability by the Department of Conservation and Extension, was prepared and has been used as the basis for the College farm development. It is worth mentioning here that the basic plan does not find complete favour with the Northern Territories representatives on the College Advisory Council.

Initial development has so far consisted of completing the ring fencing of the farm and also erecting a certain amount of internal fencing. The laying out of some main internal roads has been undertaken and, because of natural hazards, e.g., dolerite boulders on and below the surface, this has been a lengthier job than at first anticipated.

Equally so, the preparation of arable lands from the existing "old native lands" has been, and will continue to be for an unknown period in the future, a time-consuming process. It is a fair comment that the farm presents some hazards of use which might have been more fully appreciated before it was recommended for purchase as being suitable for an Agricultural College.

Lands which it is hoped will be in cultivation in the coming season, have been soil sampled and sent for analyses and fertilizer recommendations by the Chemistry Branch.

A farmyard area has been surveyed and planning of it—in relationship to the "dual purpose" needs of the College and the farm—has been initiated. Advice is being freely sought from acknowledged specialists in the Departments of Research and Specialist Services and Conservation and Extension and, although this advice may be in conflict with the ideas and opinions of members of the College Advisory Council, it is being implemented. Some of this work will inevitably have to be delayed until staff, who will be closely connected with the buildings and layout in their work, have been appointed and can be consulted.

A major development recently undertaken is the provision of an adequate road crossing of the Nyawiye River to give access to the eastern side of the College farm. Following a visit by an engineer, the Roads Department has supplied a detailed plan. It is hoped that the finished drift will allow almost unrestricted crossing of the river all the year round.

The criticism has been made that the Farm Plan does not include provision for demonstrating small farm units. It must be clearly realized, however, that such an approach is fundamentally and basically unsound for the teaching of present day husbandry and technology of Agriculture *at Diploma level.*

EQUIPMENT

Two Ferguson "35" tractors, with tipping trailers, and a Bedford ¾-ton truck are on hire from C.M.E.D. A 5-ton lorry may be available before the end of 1960.

A number of farm implements have been bought, or transferred from other stations, up to the end of the year under review. Tenders are on hand for the supply of a planter.

The most urgent need is for a heavier tractor. It is intended to estimate for the supply of a Ferguson "65" in the 1961/62 year.

EDUCATIONAL

A provisional prospectus and syllabus has been prepared and will shortly be circulated to all schools in the Federation providing secondary education for Africans.

GENERAL

The Principal made a trip to the two Northern Territories in January, 1960, submitting a detailed report on his return. A progress report, January-March, 1960, was compiled. A memorandum was prepared for the Monckton Commission and a party of the Commissioners was addressed on the subject of Chibero College during a visit to Gwebi College. The College staff has endeavoured to attend I.C.A. Field Days, and Farmers' Association Meetings in order to meet the local farming community.

CONCLUSION

At the time of preparation of this report, it is obvious that the development and progress of the College, and the farm, will depend on the provision of an adequate, stable water supply.

REPORT OF THE FEDERAL DEPARTMENT OF CONSERVATION AND EXTENSION

For year ending 30th September, 1960

J. J. DUVENAGE, *Director*

INTRODUCTION

Under this heading matters dealing with the two Rhodesias in general will be considered and items specifically concerning the individual territories will be reported upon under Southern Rhodesia (B) and Northern Rhodesia (C). Using this system of presentation, the federal nature of the Department will be emphasized.

The year 1959/60, while marking the end of a decade, also saw the promotion of C. A. Murray, O.B.E., to the post of Secretary to the Federal Ministry of Agriculture. As the Department was built up under his guidance it is pertinent to review the progress since the inception of the Department on federal lines. This progress substantiates the statement in the Report of the Advisory Commission on the Review of the Constitution of Rhodesia and Nyasaland, page 135, para. 9, that "The Federal Agricultural staff are recognized not only in Africa but elsewhere as providing one of the finest agricultural services possible".

This truism is a fitting tribute to the man whose boundless energy and enthusiasm developed the Federal Department of Conservation and Extension in the two Rhodesias.

A. GENERAL

1. ORGANIZATION

During the year certain posts were upgraded and a number of additional posts were authorized in the 1960/61 Estimates. To enable the Department to continue with Work Study, two officers were transferred from their normal duties to undertake this investigation.

Upgradings. On the 1st January, 1960, the following posts were upgraded to a more realistic level:—

(a) Chief Planning and Training Officer from £2,365 to £2,470.
(b) Five Regional Conservation and Extension Officers from S.P.O. I to £2,365.
(c) One Senior Planning Officer from S. & T.O. II & I to £2,365.
(d) One Planning Officer (Northern Rhodesia) from S.P.O. II to S.P.O. I.
(d) One Research Officer from P.O. to S.P.O. II.

The following additional posts were authorized:

(a) One Senior Training Officer.
(b) Two Conservation Officers for Northern Rhodesia.
(c) Two Conservation Officers for Southern Rhodesia.
(d) One Farm Assistant for Chalimbana Experimental Farm, Northern Rhodesia.
(e) One computational Assistant Branch III Scale E for Erosion Research.
(f) One Clerk Typist for the Sabi Team.
(g) One Conservation Assistant (Scribe) for the Eastern Region.

While these improvements in the organization of the Department were very necessary, it is of importance that the whole structure should be reviewed in the immediate future. The Department has grown over the years and many of the posts and the duties attached to these posts have been expediencies. Highly qualified officers have to spend an unreasonable proportion of their time undertaking duties which could well be performed by less-experienced men, and additional duties which, although at their level, are outside their general field.

The question of the grading of many of the posts must be given very serious consideration. Suitable men are becoming more and more difficult to obtain and to retain. This fact has been appreciated in many countries and even within the Federation itself.

A review of the Department is at present being carried out internally to evaluate the present position and to suggest where improvements can be made to increase the efficiency of the existing man-power and to indicate how the quality and quantity of the services to the farmers can be improved. This exercise will naturally involve a considerable amount of research and discussion.

Having evolved from the Southern Rhodesia Service with the Federal and Southern Rhodesian Headquarters being more or less one and the same, there has been a tendency for them to be identical and Northern Rhodesia to be considered as an off shoot. The Service, of course, is a Federal one operating in both countries as a consolidated though flexible team. The object of the reorganization is to strengthen the Federal outlook.

2. STAFF

The promotion of the Director to be the Secretary of the Federal Ministry of Agriculture set in motion a series of promotions which were not completed during the year under review.

The chief changes were as follows:

The Director—J. J. Duvenage, from Deputy Director.

Deputy Director—C. K. Thompson, from Regional Director, Northern Rhodesia.

Regional Director, Northern Rhodesia—R. H. Fitt, from Regional Conservation and Extension Officer Midlands, Southern Rhodesia.

In addition the Chief Tobacco Extension Officer resigned at the end of the year.

(a) *Establishments*

The following table gives the establishment of the Federal Headquarters, but it must be noted that the Southern Rhodesia Headquarters are at present merged with them, particularly with regard to the administration staff.

The establishments concerning Northern and Southern Rhodesia are given under their respective sections later in this report.

Title	*Authorized 1.7.56*	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
SECTION A				
Directorate				
Director	1	1	1	1
Deputy Director	1	1	1	1
Assistant Director (at present S.C. & E.O.)	1	1	1	1
Information Officer	—	—	—	1
Headquarter Administration, Federal and Southern Rhodesia				
Chief Executive Officer	—	—	—	1
Senior Executive Officer	1	1	1	1
Higher Executive Officer	—	1	1	2
Administrative and Executive Officers	2	1	1	1
Clerical Officers (male)	3	3	3	4
Senior Clerical Officer (woman)	1	1	1	1
Clerical Officers (woman)	5	6	6	6
Stenographer	—	—	—	1
Copy Typist (Branch III)	—	—	—	2
Office Orderlies (Branch IV)	2	2	2	3
Driver (Branch IV)	—	—	—	1
Engineering Branch				
Chief Conservation Engineer	1	1	1	1
Senior Research Engineer	1	1	1	1
Conservation Engineer	—	—	—	1
Research Engineer	—	1	1	1
Research Officer	1	1	1	1
Farm Machinery Adviser and Assistant	1	1	1	2
Farm Buildings Adviser and Assistant	1	1	1	2
Senior Mechanical Engineer	1	1	1	1
Working Account Inspectors (Southern Rhodesia)	6	6	6	6
Technical Assistant, Erosion Research	—	—	—	1
Working Account Inspectors (Southern Rhodesia)	6	6	6	6
Technical Assistant, Erosion Research	—	—	—	1
Draughtsman Topographer	—	—	—	1
Technical Assistant Drainage Research	—	—	—	1
Senior Conservation Assistant (Research)	—	1	1	1
Conservation Assistants (Research)	4	3	3	3
Computational Assistant (Research)	—	—	1	1
Carried forward	39	41	42	58

Title	*Authorized 1.7.56*	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
Brought forward .	39	41	42	58
Irrigation Branch				
Senior Irrigation Officer	1	1	1	1
Irrigation Officers (Southern Rhodesia)	1	1	1	2
Planning and Training Branch				
Chief Planning and Training Officer .	—	1	1	1
Senior Planning Officer	—	1	1	1
Senior Training Officer	—	—	1	1
Senior Agricultural Topographer .	—	1	1	1
Agricultural Topographers (Southern Rhodesia)	2	4	4	4
Soil Pedologists	—	2	2	2
Senior Works Study Officer . . .	—	—	—	1
Works Study Officers	—	—	—	4
Agricultural Economists (seconded from D.R. & S.S.)	—	—	—	2
Sabi Catchment Planning Team				
Group Conservation and Extension Officer	—	1	1	1
Conservation Officers	—	5	5	5
Topographer	—	1	1	1
Clerk/Typist (Branch III)	—	—	1	1
Survey Hands (Branch IV) . . .	—	4	5	5
Senior Y.F.C. Organizer (Southern Rhodesia)	1	1	1	1
Librarian	—	1	1	1
Tobacco Branch				
Chief Tobacco Extension Officer . .	1	1	1	1
Tobacco Extension Officer . . .	1	1	1	1
Livestock Improvement Branch				
Animal Husbandry Officer . . .	1	1	1	1
TOTAL	47	68	72	96

(b) *Visits to Other Countries*

Through the generosity of organizations such as the International Co-operation Administration, the Ford Foundation of the U.S.A., the Food and Agricultural Organization of the United Nations, the Rockefeller Foundation and the co-operation of the Federal Government, it was possible for certain members of the Department to visit the U.S.A., Britain, Holland and Western Germany. In addition visits were also made to the Union and Nyasaland.

Experience has shown that these visits are of the greatest possible value to those who have been able to make them and in the interest of the Service. The officers concerned who have undertaken these study tours are greatly strengthened in the broad field of agricultural knowledge and techniques and in consequence are of more value than ever to their colleagues in the Department and to the farmers whom they serve.

Details of the individual visits are given below:

- (i) The Senior Animal Husbandry Officer for Northern Rhodesia, Mr. F. B. Rhodes, under the auspices of the International Co-operation Administration, visited the U.S.A., Western Germany and the United Kingdom studying:—
  - (a) Extension methods, with particular reference to animal husbandry.
  - (b) Dairy herd improvement, with emphasis on—
    - (i) herd improvement schemes;
    - (ii) utilization of low quality roughages; and
    - (iii) mechanization of milk and forage production.
  - (c) Performance testing of livestock.
  - (d) The practical application of these findings in the field.
- (ii) The Regional Conservation and Extension Officer of the Eastern Region, Mr. A. W. Teague, also under the auspices of the International Co-operation Administration, visited the U.S.A., the United Kingdom and Western Germany to study extension methods, land-use, farm and catchment planning, horticulture, forestry, cropping and livestock integration into workable farming systems.
- (iii) The Chief Planning and Training Officer, Dr. V. Vincent, with a fellowship from the Food and Agricultural Organization of the United Nations, visited the U.S.A. and Western Europe to study land-use planning and allied subjects, including the extension services.

(iv) Senior Training Officer, Mr. D. E. Baker, was awarded a grant by the Rockefeller Foundation to visit the U.S.A. for the purpose of studying the various aspects of youth work and extension and training methods.

(v) Group Conservation and Extension Officer, Mr. L. H. Cruttenden, under the auspices of the International Co-operation Administration, visited the U.S.A., the United Kingdom and Western Europe to study farm planning, extension methods and livestock improvements.

(vi) Messrs. J. H. H. Louwrens (Regional Conservation and Extension Officer, Matabeleland), R. R. Graham (additional Regional Conservation and Extension Officer, Mashonaland) and E. L. G. King (additional Regional Conservation and Extension Officer, Northern Rhodesia) completed their tours of the U.S.A., Holland and the United Kingdom under the auspices of the Food and Agricultural Organization.

(vii) Conservation and Extension Officers P. Hawkins and G. Jones, of the Northern Rhodesian Planning team, attended a course in photo interpretation and soil survey at the International Training Centre for Aerial Survey, Delft, Holland.

(viii) The Farm Machinery Engineer, Mr. H. A. Templeton, visited France, Equatorial Africa and the Ivory Coast to study the cultivation and mechanization of groundnuts.

(ix) The Tobacco Extension Officer, Mr. J. Jameson, who was awarded an Archie Henderson Memorial Trust grant, visited the Union of South Africa to study the production of Turkish and flue-cured tobacco.

(x) Senior Tobacco Extension Officer (Northern Rhodesia), Mr. R. J. C. Hope, visited Nyasaland.

(xi) Senior Conservation Engineer (Northern Rhodesia), Mr. S. Durbach, visited Nyasaland to advise the Agricultural Department on the subject of heavy earth-moving equipment.

(c) *Representation on Committees*

The Director and/or the Deputy Director served on the following committees dealing with matters concerning the Federation:—

(i) Federal Standing Committee on Agricultural Production.

(ii) Tobacco Research Board.

(iii) Research Advisory Committee of the Department of Research and Specialist Services.

(iv) Field Experimentation Committee.

(v) Drought Relief Committee.

(vi) The Groundnut and Sorghum Advisory Committee.

(vii) Council of the Rhodesian and Nyasaland Association of Young Farmers' Clubs.

(viii) The Ministry's Committee on Banana Production.

(ix) National Seed Campaign Committee.

(x) Gwebi College Council.

They also served on the following committees concerned with matters pertaining to Southern Rhodesia.

(i) Livestock Improvement Committee.

(ii) Natural Resources Board (Advisory).

(iii) Water Resources Committee of the Natural Resources Board.

(iv) Conservation Education Committee of the Natural Resources Board.

(v) Subdivision of Land Committee of the Natural Resources Board.

(vi) Native Affairs Committee of the Natural Resources Board.

(vii) Mineral Resources Committee of the Natural Resources Board.

(viii) Cabinet Sabi Development Committee.

(ix) National Parks Board.

(x) Land Settlement Board.

(xi) Sabi Development Farm Committee.

(xii) Bothashof School Council (Government representation).

Other senior officers of the Federal Headquarters staff also served on some of these and other departmental committees.

(d) *Publications*

	Title	*Author*	*Publication*
1.	The Importance of Land Preparation	C. Rose	*Rhodesian Tobacco Journal*, June, 1960.
2.	United Kingdom Grades	C. Rose	*Good Farming.*
3.	Tobacco Bulletins	C. Rose and J. Jameson	*Rhodesian Farmer.*
4.	Flue-cured Tobacco	C. Rose	Issued in pamphlet form.
5.	A Preliminary Account of the Vegetation of South Matopos I.C.A.	P. Ingram	*Rhodesia Agricultural Journal*, July/August, 1960.
6.	Economic Factors in Farm Planning	M. R. Colebrook	*Rhodesia Agricultural Journal*, March/April, 1960.
7.	A Preliminary Account of the Vegetation of the Banket and Eldorado I.C.A.	P. Ivy	*Rhodesia Agricultural Journal*, Sept./Oct., 1960.
8.	The Ecology and Land-use of Gwanda I.C.A.	L. H. Cruttenden	*Rhodesia Agricultural Journal*, March/April, 1960.
9.	The Farming Calendar	Department of Research and Specialist Services in collaboration with Department of Conservation and Extension.	Various issues of the *Rhodesia Agricultural Journal.*
10.	The Siting, Construction and Maintenance of Farm Roads with Special Reference to Tobacco Growing	J. Jameson	*Rhodesian Tobacco.*
11.	Turkish Tobacco, Notes 1 to 5	J. Jameson	Issued in pamphlet form.
12.	Curing with the Wet Bulb	W. R. Robertson	*Rhodesian Tobacco.*
13.	The Use of Machinery in Cultivation and Handling of Groundnuts	H. A. Templeton	*Rhodesian Farmer.*
14.	Some Principles of Overhead Irrigation	G. Turck	*Rhodesian Farmer.*
15.	Will Raspberries become a Commercial Crop in Southern Rhodesia	M. A. Cassidy	*Rhodesian Farmer.*
16.	Flood or Overhead Irrigation	G. Turck	*Rhodesian Farmer.*
17.	Some Aspects of Lucerne Growing	G. Turck	*Rhodesian Farmer.*
18.	Conservation Comment	C. Sharman	*Rhodesian Farmer.*
19.	Correct Irrigation at Critical Periods	G. Turck	*Rhodesian Tobacco Journal*, September, 1960.

In addition, numerous articles were published in the daily Press, especially in "Show Supplements".

While comparatively few scientific papers are published, the popular advisory articles are an essential media of the advisory services.

3. EXPENDITURE

Vote 41	Federal Headquarters and Southern Rhodesia	1959/60		1960/61
		Authorized	Actual	Authorized and Anticipated Expenditure
A	Salaries, wages and allowances for the department as a whole	352,117	349,381	383,706
B	Travelling and subsistence	19,940	17,222	20,060
C1	Books and periodicals	260	250	250
C2	Camping equipment	50	50	40
C3	Experimental equipment for conservation works	3,185	3,112	4,150
C4	Leave entitlements	1,000	1,285	1,000
C5	Office and miscellaneous	1,815	1,633	2,600
C6	Purchase and upkeep of instruments and technical furniture and equipment	1,649	1,641	1,700
C7	Recruiting expenses	775	1,833	1,750
C8	Teachers training courses	200	54	80
C9	Water, light and sanitary charges	1,350	1,563	1,400
D	Housing	2,040	2,606	1,600
E1	Field trials and other works	8,675	8,625	8,300
E2	Work on European farming land in terms of section 23 of the Southern Rhodesia Natural Resources Act, 1941	3,250	3,250	7,830
G2	Chipinga Experimental Farm	5,410	5,744	6,100
G4	Karoi Experimental Farm	6,950	6,843	6,800
H	Transport and equipment	72,850	72,197	74,000
J	Farm planning (air photography)	3,563	3,563	3,560
H	Transport and equipment	72,850	72,197	74,000
K	Assistance to university students:			
	1. Bursaries	1,050	825	750
	2. Loans	650	500	350
	TOTAL	£486,779	£482,177	£526,026

4. ADVISORY SERVICES

(a) *Tobacco Advisory Work*

The work carried out by officers trained to advise in tobacco is given in the analysis of visits shown below:

	1959/60	1958/59
Farm visits	6,264	5,905
Tobacco Research Board visits	331	376
Grading shed inspections	142	197
Miscellaneous	565	732
	7,302	7,210
Discussion Groups	358	432
Attendance	6,211	7,496

Of the 6,264 farm visits 3,292 (57 per cent. of all farms visited) were made at the request of the farmers concerned. This figure is identical to that for the 1958/59 season.

Both the number of discussion groups held and the attendance figures have dropped. This is probably due to the fact that the better farmers are reasonably satisfied with their progress and the poorer producers are not interested. In fact while the discussion group provides an important meeting ground for discussion between farmers, many farmers are already producing at a high level. Those who could most benefit by the sort of information discussed seldom attend. These farmers, who are largely unaware of what they do not know, can only be reached by the extension officer making "free lance" visits to the farm. But unless the approach is right and the farmer gains confidence in the officer as a prelude to the latter offering advice, very little or no impression is likely to be made. There is little doubt that extension efforts should now be directed towards the less efficient grower in order to raise his standard of production. In order to do this and to be able to carry out the many other duties which must be done, reorganization of the tobacco advisory service will have to be considered.

Continued close contact with the Tobacco Research Board, Rhodesia Tobacco Marketing Board, Rhodesia Tobacco Association, Tobacco Export Promotion Council of Rhodesia and the Tobacco Trade Association has ensured that the Department has been kept up to date with developments in the industry. Close contact has also been established with the Central African Turkish Tobacco Growers' Association. Nyasaland was visited by the Chief Tobacco Extension Officer (Salisbury), the Senior Tobacco Extension Officer (Lusaka) and the Tobacco Extension Officer (Salisbury) in pursuance of the policy of co-operation between the Department of Agriculture, Nyasaland, and this Department.

(b) *Land Use Planning*

(i) *Aerial Photography*. In keeping with the Department's annual flying programme, designed to keep the photographic coverage as far as possible up to date, a total coverage of 3,560 square miles was undertaken at 1:40,000 scale. As a result of economies affected by the Treasury this area amounted to only half of the original cover asked for, and it is important to note that additional financial cuts will seriously affect the Departmental objective of having no photography more than five years old.

It is also disturbing to find that 1:40,000 scale photography, which was accepted by the Department during 1959 purely for economic reasons, is now rapidly approaching the contract price per square mile which applied to 1:20,000 scale photography only a few years ago.

Anomalies in the 1959 Royal Rhodesian Air Force photography still continue to come to light. Gaps still exist in flight runs where no gaps are shown on the flight index. The Department of Federal Surveys has given an assurance that these gaps are being plotted, on completion of which the Royal Rhodesian Air Force will be called upon to close them.

(ii) *Land Classification*. Specific investigations into the classification criteria in both the high and low rainfall areas of Southern Rhodesia have resulted in a more realistic approach being adopted to the interpretation of natural soil, land and climatic characteristics, with associated improvements in the soil coding system. New criteria for the very high rainfall areas of the Eastern Districts of Southern Rhodesia and parts of Northern Rhodesia, however, still remain outstanding.

The services of the third pedologist during the forthcoming year will be of considerable help in ironing out individual weaknesses in soil coding that are still apparent in certain of the field staff, whilst periodic refresher courses will eventually eliminate a number of shortcomings in the land classification system which have been traced to neglect of the initial air photo-interpretation of the land before field examination begins.

(c) *Agricultural Engineering*

Requests from the agricultural industry for advice and assistance on engineering matters increase from year to year, both in number and in the range of subjects covered, as the industry becomes more mechanized and more aware of the value of efficient buildings and equipment in reducing production costs. In spite of this constantly growing demand the number of staff available has remained virtually unchanged for ten years, and the result is that the advisory services are completely overwhelmed. In each of the three main fields of farm machinery, farm buildings and drainage, only one engineer is available for the whole Federation.

(i) *Farm Machinery Advisory Service.* Apart from an ever-increasing number of requests for advice from individual farmers, associations and other Government departments, which the Department did its best to satisfy, a major exercise was the study of the mechanization of groundnut production; short study tours were undertaken to obtain first-hand information of current practice in the Republic of South Africa and the French Territories in Africa.

In the field of machinery demonstrations the new approach was tried of holding large demonstrations of a wide range of implements by several manufacturers. In spite of support and assistance from both the Rhodesia National Farmers' Union and trade organizations, the attendance was so disappointing that further demonstrations of this type are not planned at the moment.

Several highly successful ploughing matches were organized and it is hoped to stimulate to an even greater degree the great interest in good ploughing by the organization of further competitions.

(ii) *Farm Buildings Advisory Service.* No less than 1,181 requests were received for advice on farm buildings and structures. Particularly in the tobacco industry the need for higher standards of curing and handling is leading to tremendous interest in more efficient tobacco buildings. In order to make present knowledge more available to the industry, increasing use will be made of advisory bulletins but the preparation of such literature is handicapped by the lack of an engineering draughtsman.

Twenty-six field days and discussion groups on buildings were held during the year, and assistance was given in the design of a new and greatly improved heating system for tobacco barns.

Additional staff are urgently required if this valuable advisory service is to function with continued efficiency.

(iii) *Drainage Advisory Service.* Again only one engineer is available and he is concerned mainly with research into the many local problems of surface and underground drainage. Although this emphasis on research will be maintained for some years, it is obvious that the trials already conducted have aroused much interest in practical applications of the knowledge now available.

5. TRAINING

The Planning and Training Section has been heavily committed in organizing and supervising training courses during the year, the absence of a Training Officer having been felt particularly strongly.

(a) *Initial Training*

Twenty-three newly-recruited officers underwent initial training in the Planning Section, being instructed in basic photo-interpretation and planning procedures by the staff of the Planning and Training Section.

(b) *In-service Training*

Three farm planning courses and one farm planning refresher course were held. Eighty-seven officers attended these courses, the detailed breakdown being:

Officers of the Department of Conservation and Extension	45
Northern Rhodesian Department of Native Agriculture	23

Northern Rhodesian Government Mount Makulu Research Station Staff	4
Northern Rhodesia Government Department of Lands	3
Southern Rhodesia Government Department of Native Agriculture	2
Chemistry Branch, Federal Department of Research and Specialist Services (Southern Rhodesia)	4
Swaziland Department of Native Agriculture	1
Nyasaland Department of Native Agriculture	4
University College of Rhodesia and Nyasaland	1
	87

These courses brought the total number of officers trained in the Department's farm planning techniques to 480 of which 300 belonged to this Department.

Training in other fields for departmental staff comprised:

(i) Two irrigation courses attended by a total of 25 officers.
(ii) A mechanical conservation course attended by 30 officers.
(iii) A stereo-interpretation course attended by 19 officers.

(c) *Farmer Training*

Seventeen Irrigation courses were held in the more dispersed centres of the Federation and were attended by 349 farmers. In addition 15 Cattle Courses were held attended by 570 farmers. This achievement is particularly noteworthy considering the absence of the Training Officer throughout the year.

(d) *Work Study*

Mr. Squire undertook practical work measurement and method study of the full sequence of tobacco operations under the direction of Messrs. H. H. Fraser and Associates, the consultants engaged by the Rhodesian Tobacco Association. He was also engaged in helping Mr. J. Cheshire—Fraser's Chief Engineer—with the writing and checking of the Work Study Manual and with the organization and running of the first series of Work Study Appreciation Courses, taking over an increasing amount of the lecturing from Mr. Cheshire as the series progressed.

Altogether six successful courses were held which were attended by 33 Tobacco Extension Officers from this Department, two farmers and two senior members of the Tobacco Research Board.

6. CONSERVATION RESEARCH

(a) *Erosion Control*

The overall progress during the year was reasonably satisfactory. The fact that the Senior Research Engineer had to act as Chief Conservation Engineer for three months while the Chief Conservation Engineer was on a study tour, and that demands for increased research have not been accompanied by any increase in staff, inevitably restricted the progress that might otherwise have been made in this field.

Report on Present Research Programme

(1) The "length of slope" experiment which gives information on the optimum spacing for contour ridges, has been transferred to a sand soil. After six years of operation on the red soil, sufficient results have been obtained which show quite clearly that the present design method used in the Department for determining the spacing of contour ridges is satisfactory. It is anticipated that similar results will be obtained on sandy soils, and the experiment is being continued to test this.

(2) The classic "mosquito gauze" experiment which has shown the supreme importance of cover in preventing erosion on clay soils, is now also being done on a sandy soil. That on the clay soil is being continued.

Both these two new experiments referred to under (1) and (2) are under construction now, and will be brought into operation for a calibration period during the 1960/61 season for experimental recording during the following year.

(3) One minor experiment on red soil has been discontinued. This compared the efficiency of protective cover provided in the form of growing grass with that provided in the form of a surface mulch of dead vegetation. It is clear from the results of the past five seasons that there is no significant difference in the efficiency of different types of protective cover.

(4) A large number of miniature run-off plots have been operated for two seasons with the object of determining whether replicated small plots can be used as a substitute for the very expensive conventional field-scale plots. The results show that minor variations in the soil and crop growth reduce the accuracy below the level required for critical investigations and the experiment has therefore been discontinued. The design is, however, suitable for less accurate demonstration plots and the equipment will be issued to schools and Young Farmers' Clubs for this purpose.

(5) A detailed study was continued of the characteristics of sub-tropical storms and the way in which these are related to the erosive properties of rain. Most of the required experimental data has been obtained and is being correlated and analysed. The experiment will continue with a reduced number of observations to obtain further information on the very severe storms which occur infrequently. The ultimate object of this study—the design of portable run-off and erosion measuring equipment—will follow after the study of rainfall characteristics is completed.

(6) Light rains during the 1959/60 season made it possible to catch up on the backlog of routine laboratory analyses. Analysis is continuing and the study of the data now available is in hand.

(7) The Joint Evapo-transpiration Project has been temporarily placed on a care and maintenance basis because all the members of the working party originally operating the experiment have, with the exception of the Senior Research Engineer, been transferred or left their respective services. The future of the project is uncertain. It is hoped that it will be revived under the direction of the Soil Physicist of the Department of Research and Specialist Services.

(8) The field-scale experiments comparing trash farming and stubble mulching at high levels of fertility were continued. Results to date have shown that maize production under both systems is completely practicable and virtually eliminates both run-off and erosion.

(9) The main run-off and erosion experiments on four different soil types continued. Because of the poor season disappointing yields were obtained in all cases and there was little of interest in the measured soil losses. The sandveld tobacco-grass rotations included the first tobacco crops grown after various treatments of established pastures.

(b) *Drainage Research*

The first phase of the drainage research programme continued with little change during the year. During the 1959/60 rainy season field experiments were conducted on:

(1) A preliminary study of the effects of tile drainage on most of the major soil types.

(2) A more detailed study of the four existing tile drainage schemes in the Norton I.C.A.

(3) The effect on surface run-off of ridge and furrow land preparation in the Gatooma area.

During the 1960 winter this programme was continued with the installation of thirteen further tile experiments—bringing the total number to twenty-two—instrumentation of two more existing tile drainage schemes at Norton and the installation of three more surface drainage layouts near Hartley. All of these were constructed with the co-operation and assistance of the landowners. Some are still in the process of being finished in time for operation during the 1960/61 rainy season.

The low rainfall of the 1959/60 season did not allow an accurate assessment to be made of the effects experienced during a normal summer. The experiments all continue unchanged.

(c) *Catchment Studies*

(i) *Sabi.* Satisfactory progress has been made in the hydrological study of run-off from small catchments which is operated jointly by this Department and the Hydrological Branch of the Division of Irrigation. One large gauging weir was built by the Hydrological Branch using Southern Rhodesia Government funds, and four smaller weirs were built using funds provided by this Department. In addition ten prefabricated flumes were built, and these will be installed by the Hydrological Branch. A considerable number of these gauging weirs should be in operation during the coming season.

No run-off occurred in the 1959/60 season and in consequence no results were obtained.

(ii) *Matopos Research Station*. It is planned to study, in conjunction with the Hydrological Branch and the Department of Research and Specialist Services, the effects of different grazing treatments on surface run-off. The catchments have been surveyed, flumes and recorders are available, and it is hoped that the Hydrological Branch will carry out the field installation shortly.

(iii) *Erin Hydrological Catchment*. This project in the Eastern Districts is sponsored by the Hydrological Co-ordinating Committee and the object is to measure the effect of afforestation on stream flow and erosion. It involves co-operative work by many Departments and other organizations, the contribution of this Department being the provision of maps and photographs, a preliminary soil survey, siting of instruments and surveys of present gully erosion.

Rainfall and stream gauging have already started but this is a long-term project and results will not be available for several years.

(d) *Run-off Plots*

Small-scale run-off plots are in use in three I.C.A.s within the Sabi catchment, two near Marandellas and one near Odzi. The experiments at Odzi were completed in time for their calibration period during the 1959/60 season and all three are now in full operation. No further plots of this type are planned within the Sabi catchment, but a similar group is being built at Chalimbana Experimental Farm in Northern Rhodesia.

(e) *Gully Control and Reclamation on Mopani Soils*

A comprehensive programme of gully control experiments has been initiated in the Bembezaan I.C.A. near Que Que with the object of testing simple structures and control measures of the type which could be built or developed cheaply on any farm. About 20 such designs were tested during the 1959/60 rains. It is evident that there is no simple solution to the fact that such soils are inherently unsuitable for building earth walls, and the attempts to overcome this by avoiding high water pressure on the walls, or by building dams with an exceptionally wide base, have been unsuccessful. On the other hand several types of very simple brick and stone weirs have trapped large quantities of silt, and show considerable promise if suitable vegetation can be established to stabilize the silt. As the ultimate solution is felt to lie in vegetative control measures, the Pasture Research Section of the Department of Research and Specialist Services has established a plant introduction nursery at Matopos Research Station for grasses and plants tolerant to the special conditions of mopani soils. Seeds and planting material have been obtained from many overseas countries, and although the plantings last season were badly affected by the drought conditions, this programme will continue.

These experiments on structural control are complementary to the existing trials in Bembezaan and Bembesi I.C.A.s concerned with the effects of chemical amendments and fertilizers as aids in establishing vegetation.

7. YOUNG FARMERS' CLUBS

A review of the constitution and organization of the Rhodesia and Nyasaland Association of Young Farmers' Clubs was undertaken by a special committee appointed by the Council. This committee recommended that the Natural Resources Board of Southern Rhodesia should take over the sponsorship of the Association from the Federal Department of Conservation and Extension so far as Southern Rhodesia was concerned. The movement was already operating under the aegis of the Northern Rhodesia Natural Resources Board in this Territory. All the parties concerned agreed and the transfer has been effected.

The European clubs in Southern Rhodesia will still be able to call upon the "Organizers" of the Department who will now assume their true function as "Advisers".

It is of interest to note the rapid development of the movement in African areas. In Northern Rhodesia the Organizer is to be congratulated upon the progress he has made and the recently appointed Organizer for Southern Rhodesia will no doubt have a similar response.

8. The Southern African Regional Committee for the Conservation and Utilization of the Soil

The Director and the then Regional Director for Northern Rhodesia attended the 7th Meeting of S.A.R.C.C.U.S. held in Nyasaland. As usual the meeting was of an extremely high standard being preceded by a most informative tour of the Southern and Central Provinces. The value of S.A.R.C.C.U.S. is brought out more and more with each gathering.

S.A.R.C.C.U.S. is a powerful stimulant and driving force behind the rapid development of conservation thought and practice in the Federation The high standard of its deliberations are in no small way due to the inspiration and enthusiasm of Mr. C. A. Murray lately Director of this Department. The Federation's delegates are extremely prominent and are highly respected in the organization.

B. SOUTHERN RHODESIA

1. Organization

(a) *Head Office*

As the Southern Rhodesia Headquarters are merged with the Federal Headquarters the matters dealt with earlier under item A.1. apply here also where Southern Rhodesia is concerned.

(b) *Regional Offices*

The Public Services Commission has been asked to examine the clerical posts in Regional Offices with a view to upgrading them.

Clerical assistance in the form of Branch III personnel are gradually being introduced at Group and Regional level but while the applicants are usually very numerous there are very few who prove suitable at present.

(c) *Intensive Conservation Areas*

The position in regard to Intensive Conservation Areas can be summarized as follows:

(i) Declared during the year: Karoi Central.
(ii) Investigated or under investigation for declaration: Nil.
(iii) Subdivided during the year: Karoi North and Karoi South to form the additional Karoi Central I.C.A.
(iv) Investigated or under investigation for subdivision: Darwin.
(v) Boundaries changed: North Ayrshire; South Ayrshire; Banket.
(vi) Investigated or under investigation for boundary changes: Eldorado; Banket; Marodzi-Tatagura; Upper Ngesi; Tokwe; Trelawney; Umvukwes; Gwebi-Hunyani; Selukwe; Nuanetsi-Mtilikwe.
(vii) The total number of I.C.A.s declared in Southern Rhodesia is 94, as compared with 91 when Agriculture became a Federal responsibility.

With the increased alienation of land and subdivision of farms the position in the Mashonaland Region is becoming critical as is well demonstrated in the various statistics appearing in this report. In the very near future the Region will have to be split into two in order to provide more efficient administration and to give more adequate facilities to the farmers. The position in regard to I.C.A.s, Groups and Regions is now as follows:

Region	*Group*	*I.C.A.*
Mashonaland . . .	Mazoe	1. Marodzi-Tatagura.
		2. Glendale.
		3. Bindura.
		4. Shamva.
		5. Umvukwes.
		6. Darwin.
		7. Horseshoe.
	Salisbury	8. Salisbury South.
		9. Gwebi-Hunyani.
		10. Norton.
		11. Beatrice.
		12. Salisbury West.
		13. Ruwa.
		14. Arcturus.

Region	*Group*	*I.C.A.*
	East Hunyani	15. Eldorado.
		16. North Ayrshire.
		17. South Ayrshire.
		18. Darwendale.
		19. Trelawney.
		20. Banket.
	West Hunyani	21. Angwa North.
		22. Angwa South.
		23. Doma.
		24. Karoi North.
		25. Karoi South.
		26. Karoi Central.
	Marandellas	27. South Wedza.
		28. North Wedza.
		29. Wenimbi.
		30. West Marandellas.
		31. North Marandellas.
		32. Bromley.
Eastern	Mid-Eastern	33. Mayo.
		34. Macheke.
		35. Nyandora.
		36. Mtoko.
		37. Headlands.
		38. Rusape.
		39. Odzi.
		40. Tsungwezi.
	Eastern	41. Inyanga.
		42. Umtali North.
		43. Umtali South.
		44. Cashel.
		45. Melsetter.
		46. Chipinga.
Midlands	Gwelo	47. Gwelo.
		48. Gwelo East.
		49. Selukwe.
		50. Vungu.
		51. Upper Ngesi.
	Umfuli	52. Suri Suri.
		53. Selous.
		54. Sokis.
		55. Umfuli.
		56. Umsweswe.
		57. Gadzema.
	Que Que	58. Bembezaan.
		59. Sessombi.
		60. Battlefields.
		61. Umniati-Sebakwe.
	Charter	62. Featherstone.
		63. Enkeldoorn.
		64. Gutu.
		65. Tokwe.
		66. Umvuma.
		67. Chatsworth.
	Victoria	68. Umshandige.
		69. Victoria Central.
		70. Victoria East.
		71. Sabi Valley.
		72. Chiredzi.
		73. Nuanetsi-Mtilikwe.
Matabeleland	Gwaai	74. Upper Khami.
		75. Lower Khami.
		76. Upper Umgusa.
		77. Lower Umgusa.
		78. Bubi.
		79. Inyati.
	Shangani	80. Shangani.
		81. Insiza.
		82. Essexvale.
		83. Mchingwe.
	Umzingwane	84. Filabusi.
		85. Belingwe-Shabani.
		86. Gwanda.
		87. Limpopo.
		88. South Matopos.
	Western	89. Plumtree.
		90. Marula.
		91. Figtree.
		92. North Matopos.
		93. Gwaai.
		94. Matetsi.

(d) *I.C.A. Committees*

From the inception of this valuable movement a tremendous amount of good work was done by the I.C.A. Committees during the year in promoting a keen interest in conservation and better farming.

This year the strength of the organization was manifested during the drought relief campaign, in which it took part. The speed and efficiency with which the Committees and the staff of the Department worked was most noteworthy and helped tremendously to redeem a situation which at one time seemed black indeed.

This drought relief exercise also clearly demonstrated the benefits of the ward system.

(e) *Group Organizations*

With the ever-increasing number of committees grows the importance of the Group Organization as a co-ordinating and stimulating body.

(f) *Representation on Committees*

In addition to the Southern Rhodesian Committees mentioned in A2 (c), officials also served on the following more important bodies:

The Conservation Education Sub-Committee of the Natural Resources Board.
Ministry's Show Exhibits Committee.
Rhodesia Pasture Seed Growers' Association.
Regional Water Development Committees.
Sabi Catchment Protection Committee.
Dairy Production Costs Committee.
Marimba Catchment Committee.
African Farm Housing Committee.
Irrigation Advisory Committee.
Veld Assessment Committees.
Show Society Committees.

The Ministry's Committee dealing with the Dairy Industry in Chipinga and the Young Farmers' Club Committees.

2. TRANSPORT

The transport situation remained completely adequate during the year, proving once again that the current practice of allowing officers to use their private cars on official duty is an extremely satisfactory one.

Details regarding the vehicle position are as follows:

Authorized private vehicles ...	145
C.M.E.D. Vehicles	22
Outstanding applicants as at 30.9.60	14

3. STAFF

Establishment

	Authorized 1.7.56	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
FIELD BRANCH				
Mashonaland				
Regional Conservation and Extension Officer	1	1	1	2
Additional Regional Conservation and Extension Officers	—	1	1	2
Group Conservation and Extension Officer	11	10	10	11
Conservation Officers	31	31	32	34
Farm Managers	1	1	1	1
Farm Assistants	1	1	1	1
Agricultural Topographer (*see* Planning and Training Branch) . . .	—	—	—	—
Mechanical Unit Inspector (*see* Engineering Branch)	—	—	—	—
Administrative and Executive Officer	1	1	1	2
Clerical Officer (woman)	1	1	1	2
Part-time clerical assistance (European)	2	4	4	4
Clerks (Branch III)	1	2	2	2
Conservation Assistant (Scribe) . .	—	1	1	1
Conservation Assistants (Field) . .	5	7	7	7
Survey Hands (Branch IV) . . .	46	46	45	47
Orderlies, drivers, etc.	3	3	3	4
Carried forward . .	104	110	110	120

	Authorized 1.7.56	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
Brought forward .	104	110	110	120
Matabeleland				
Regional Conservation and Extension Officer	1	1	1	1
Additional Regional Conservation and Extension Officer	—	1	1	1
Group Conservation and Extension Officers	4	4	4	4
Conservation Officers	13	13	13	14
Y.F.C. Organizer (*see* Planning and Training Branch)	—	—	—	—
Agricultural Topographer (*see* Planning and Training Branch) . . .	—	—	—	—
Administrative and Executive Officer	1	1	1	1
Typist	1	1	1	1
Part-time clerical assistance . . .	—	—	—	1
Office Orderlies	1	1	1	1
Clerks Branch III	1	2	2	2
Conservation Assistants	5	5	5	5
Survey Hands	19	19	19	20
Eastern				
Regional Conservation and Extension Officer	1	1	1	1
Additional Regional Conservation and Extension Officer	—	1	1	1
Group Conservation and Extension Officers	6	4	4	4
Conservation Officers	15	15	15	16
Farm Manager	1	1	1	1
Farm Assistant (stockman) . . .	1	1	1	1
Agricultural Topographer (*see* Planning and Training Branch) . . .	—	—	—	—
Administrative and Executive Officer.	1	1	1	1
Typist	1	1	1	2
Senior Horticulturist (seconded from Department of Research and Specialist Services)	1	1	1	1
Advisory Horticulturist (seconded from Department of Research and Specialist Services)	—	1	1	1
Part-time clerical assistance (European)	2	2	2	2
Clerks (Branch III)	—	1	1	2
Conservation Assistant (Scribe) . .	—	—	1	1
Conservation Assistant (Field) . .	5	6	6	6
Survey Hands (Branch IV) . . .	22	22	22	23
Orderlies, drivers, etc.	4	4	4	4
Midlands				
Regional Conservation and Extension Officer	1	1	1	1
Additional Regional Conservation and Extension Officer	—	1	1	1
Group Conservation and Extension Officers	9	8	8	8
Conservation Officers	20	21	22	23
Irrigation Officer (*see* Irrigation Branch)	—	—	—	—
Agricultural Topographer (*see* Planning and Training Branch) . . .	—	—	—	—
Mechanical Unit Inspector (*see* Engineering Branch)	—	—	—	—
Administrative and Executive Officer	1	1	1	1
Clerical Officer	1	1	1	1
Typist	1	1	1	1
Part-time clerical assistance (European)	2	3	3	3
Clerks (Branch III)	1	2	2	2
Conservation Assistants (Branch III).	3	4	4	4
Survey Hands (Branch IV) . . .	29	29	29	30
Office Orderlies	2	2	2	2
TOTALS	280	294	296	315

4. GENERAL AGRICULTURAL CONDITIONS

(a) *Climatic Conditions—General*

Late commencement and erratic distribution characterized the rains that fell during this past season which, in consequence, was an extremely difficult one for many livestock and crop producers—not only in the drier parts of the country, but also in many of the usually better-watered areas. In a large number of I.C.A.s the actual amount of rain that fell, aside from being badly distributed, was far less than normal. Unseasonal falls in April and May helped to a certain degree to redeem the situation in the ranching areas.

The winter was comparatively mild, little frost being experienced.

Detailed information on climatic conditions that prevailed in each of the four Regions is given below:

(i) *Eastern.* The season proved to be a most trying one in the Mid-Eastern areas with drought or near drought conditions prevailing in most of the Groups. Rainfall varied from 30 to 9 inches, the greater part of the area receiving amounts in the vicinity of the lower end of the scale. Surface run-off was too small to fill dams and rivers effectively. The lower portions of Mtoko, Mayo, Tsungwesi and Odzi were most severely affected by the poor rains that fell.

In the Eastern areas falls of rain were much below normal, but variations were even more marked than in the Mid-Eastern area, ranging from 3 inches in parts of the Rathcline Block to 68 at the Eastern Highlands Tea Estate. Several severe storms occurred, which caused extensive damage to fruit, vegetables and tobacco on a number of farms.

(ii) *Mashonaland.* Although scattered showers fell in some parts in October and November, the season was characterized by a late commencement of the rains which, except in the case of a few areas, were unevenly distributed. Mid-season droughts varying from three to six weeks in duration were a common feature of the summer. Total rainfall varied from 12 to 30 inches.

Generally, March was a dry month while from three to six inches of rain fell during the period April to June. Isolated but damaging hailstorms occurred in the Umvukwes, Marandellas and Salisbury Groups.

The winter was mild and frosts were light.

(iii) *Midlands.* Climatic conditions during the 1959/60 season proved to be most unfavourable for both livestock and crops. The extended dry period, prolonged in consequence of the late arrival of the rains, resulted in livestock suffering unduly and a postponement of planting operations to a much later date than normal in many areas. Long spells of drought followed by ineffective falls of rain during the season itself aggravated the position.

Conditions in the Umsweswe, Umfuli, Sokis and Umshandige I.C.A.s deteriorated to an extent that made it necessary to declare these areas as drought stricken.

(iv) *Matabeleland.* The past season can be described as one of the worst that has ever been experienced in the Region. The impact and effect of the early cessation of the rains during the 1958/59 summer and the late commencement of the rains in November have been reflected in the poor average fodder crop yields that were achieved, in the disappointing growth that was made by the grass and by the poor livestock weight gains that were recorded. Water supplies were inadequately replenished, as is evidenced by the fact that many dams never filled. The worst affected areas were those in the lowveld embraced by the Umzingwane and Western Groups of I.C.A.s.

Late rains in April saved many farmers from what would have been one of the most disastrous seasons on record in Matabeleland.

The past winter proved mild, frost incidence being low.

(b) *Crop Production*

(i) *Food Crops:*

Maize. Because of the unfavourable season, average yields were considerably depressed and, in some cases, reached a very low level indeed as in the Umshandige I.C.A. and in the area west of the Gatooma/Chakari line where, on many farms, no crops at all were reaped. In Mashonaland individual yields varied from 2 to 30 bags per acre, the average, however, being from 10 per cent. to 25 per cent. below normal. In Matabeleland a great deal of maize that had been planted for grain was turned into silage and this also occurred, to a much lesser degree, in the Midlands.

In the true maize growing areas on the heavy soils, the practice of growing this crop continuously with high applications of nitrogen has become a standard one on the farms of the bigger growers, and the practice of ploughing in all the phosphate, all the potash and half the nitrogen requirements is increasing.

All crops were extremely free of disease and the degree of infestation by pests was very small.

Sorghums. During this past season comparatively small acreages of this drought resistant crop were grown for grain purposes—which is regrettable because there is no doubt that it would have stood up very much better to the protracted dry periods that were experienced than did maize. In the Midlands some farmers established this crop very late in the season when their maize failed either to germinate or to grow satisfactorily. Due to the time of planting and, in some instances, to lack of attention to detail on the part of the farmer, the sorghum did not do as well as it might; nevertheless, yields of between five and eight bags per acre were obtained on certain farms where maize had failed completely.

There has been a distinct revival of interest in this crop as a yielder of grain for malting purposes and farmers are being encouraged to put down increased acreages of those varieties that fulfil the requirements of the brewing trade.

Sorghum is gaining in popularity as a silage crop on the heavy-textured soils in Matabeleland.

Groundnuts. During this last season groundnuts were grown on only a small scale in various parts of Southern Rhodesia and, except in a few instances, did not yield particularly well due, in most cases, to insufficient attention having been devoted to the crop.

As a result of intensive propaganda on the part of the Ministry of Agriculture and the publication of a pre-planting price for Grade A nuts, there is every indication that the acreage planted to this valuable food crop in the 1960/61 summer will be considerably greater than it was during this last season.

Other Legumes. The same pattern of production of various varieties of beans manifested itself during the 1959/60 summer as in past years, most farmers growing small crops for ration purposes.

This is a field of production which could profitably be expanded. Soya beans, to quote a notable instance, is an exceedingly valuable, protein-rich food crop which receives far too little attention by the average farmer in the better watered areas of Southern Rhodesia. It grows particularly well in those parts of the country to which it is ecologically suited, provided it is given reasonable care and attention and the seed is correctly inoculated with the correct strain of bacteria before being planted.

Potatoes. The unfavourable season adversely affected the summer crop in the Eastern Districts and in the Midlands Region, the depredations of the potato tuber moth in the latter area contributing to this state of affairs. In the Midlands Region yields varied from 30 bags per acre for the summer crop to 50 bags in the case of that grown under irrigation early in 1960. In the Salisbury area the late 1959 crop yields were very good, being superior to those obtained from the potatoes lifted early in 1960; this summer crop was affected by late blight, the severity of the disease being closely associated with the late arrival of the rains.

Potato cultivation in Matabeleland is confined to irrigated spring and autumn crops. Out of a total of 275 acres grown during this past season in the Region, 161 were established in the Umzingwane Group. Most crops yielded reasonably well in Matabeleland.

A small but flourishing seed potato industry has developed in the high-lying area in the vicinity of Melsetter, the crop forming an important source of income on those farms where irrigation possibilities do not exist.

Wheat. The overall acreage devoted to this crop during the year under review was depressingly small—even in the Midlands where wheat has been grown on moisture retaining soils on a limited scale at various times in the past. It is of interest to record here that unusually good results were achieved in the case of an experiment in the Felixburg area designed to demonstrate the practicability of growing this cereal on the moisture retaining Kalahari sand formation. This fact, coupled with the development of several promising crosses by the Wheat Breeder at the Salisbury Experimental Station, might well serve as a stimulus to increased production of wheat in the Kalahari sand soils of the Midlands.

Barley. This crop continues to play a more important role than wheat in Southern Rhodesia due to the demand for suitable malting grain on the part of the breweries. Small acreages were grown on contract for this purpose during the past season.

Vegetables. It is most encouraging to be able to report that vegetable production in the Eastern Districts is steadily growing in importance and that processed vegetables from this part of the country, due to their excellence, are in demand not only in all parts of the Federation, but also in overseas markets. The provision of two refrigerated road trucks and one railway truck by the Rhodesia Railways has helped to solve the transport difficulties that have confronted vegetable and fruit growers in this part of Southern Rhodesia.

Elsewhere little progress has been made in this sphere of production. Individual growers continue to adjust their output according to demand as best they can. Most producers are concentrated near the large markets in Mashonaland, the Midlands and Matabeleland.

Fruit—Subtropical. A small but steady increase in the planting of citrus has taken place in the Eastern and Midlands regions which will lead, it is considered, to over-production in the former area in the near future. The first bearing of some of the trees established on a large estate in the Chiredzi I.C.A. were recently harvested and sold.

In the Eastern Districts considerable plantings of avocadoes have taken place and interest is being shown in the increased production of pawpaws for jam production. A small increase in the production of bananas has also taken place. Small plantings of litchies that have been established in the eastern part of the Region are doing well, but it is proving difficult to encourage the production of this fruit.

Elsewhere in the country the position is largely unchanged where subtropical fruit production is concerned, the supply consisting, in the main, of home-garden grown products. A notable exception are several very large citrus projects in Mashonaland, on one of which considerable expansion is taking place.

Fruit—Deciduous. A considerable improvement took place during the year in the production and marketing of deciduous fruit in the Eastern Districts, it being harvested at a more mature stage than before. The 1959/60 season apple crop was the largest yet produced in the area—in contrast to the plum crop, which was very light. Considerable expansion occurred in dessert peach plantings, the recommended varieties doing exceptionally well in the suitable areas throughout the Eastern Region. A very satisfactory crop of Bon Chretien pears was sold during the season but marketing, unfortunately, proved difficult due to the glut of imported pears that were already in the country.

Interest in grape production continues to develop in the Eastern Region, the northern low rainfall part of Mayo being an additional area in which this crop has been proved to grow successfully.

Elsewhere in Southern Rhodesia little or no development in deciduous fruit production has taken place.

(ii) *Cash Crops—Flue-cured Tobacco:*

Seed-beds. The general overall improvement in seed-bed management noted in recent years has been maintained, and the fact that an ample supply of suitable seedlings was available for October and later plantings is proof that the Tobacco Research Board's findings have proved beneficial to the majority of farmers.

Seeding rates are still on the high side and water management is still poor on many farms, but this is more attributable to an inability to supervise adequately than to a lack of knowledge.

It is considered that the time has come for the ratio between the seed-bed area and the acres to be planted to be reduced from one thirty square yard bed per acre to approximately one bed to one-and-a-half acres.

Land Selection. Although good progress has been made, better land selection based on soil pit examination is still the most urgent problem in all tobacco areas. It is essential for each tobacco farmer to know the location and total area of suitable tobacco soils on his farm in order to be able to plan for the present and the future. Most farmers do not have this information, while many others do not appreciate the importance of using only the most suitable soils for tobacco on their farms. Planting marginal soils increases the danger of poor crop returns, and the present hit-or-miss measures that are often used increase the dangers of producing tobacco of poor quality.

Land Preparation. Steady improvement has occurred but difficulties are being experienced in late ploughing. Because the soil is dry at the time that this operation is carried out, farmers are not finding it easy to plough evenly and obtain a good tilth. There is little doubt that land preparation is far easier where early ploughing is possible. Early ploughing also spreads the work load more evenly. It would appear, therefore, that ways and means of producing high quality tobacco on early ploughed lands should be found. This problem appears to be becoming worse and more and more farmers are finding themselves obliged to late-plough soils which normally fall into the early ploughing category. It would seem to be a fertility problem and is one that must be solved if the difficulties associated with late ploughing and early planting are to be overcome.

Fertilizer and Soil Ameliorants. Although high phosphate applications continued to be popular with farmers, there would appear to be a swing away from this practice to lower applications. Phosphate is the most costly item in the fertilizer bill and therefore any saving on this item will result in an overall reduction in the fertilizer and production costs of growing tobacco. Soil analysis immediately suggests itself as an effective and accurate means of determining the most economical level of phosphate application.

Split applications of nitrogen and even of complete mixtures have been more frequent than for a number of years.

The need for liming is not fully appreciated or accepted by the majority of tobacco farmers. It would be an advantage if a simple rule-of-thumb method could be worked out to determine lime applications. In this way farmers could apply dressings of lime without the necessity, except at fairly long intervals, of having a pH test made and obtaining a firm recommendation as to liming requirements.

Planting. Water planting in Southern Rhodesia commenced generally on or about the 26th October, although a slow start was made on the 19th and 20th of that month. Planting began a week later in North Western Rhodesia and not until towards the end of November in North-Eastern Rhodesia. Figures relating to the percentage of the crop that it is estimated had been planted out by certain specific dates are given below.

Date	*Percentage of Crop Estimated to have been planted out*
31.10.59	25
20.11.59	65
15.12.59	90
15. 1.60	100

Approximately 75 per cent. of the crop was planted with water and much of this was treated with an insecticide.

There were a number of cases where rewatering had to be done on tobacco planted before the 20th October. Stands suffered which served to bring home to the farmers concerned the danger of starting too early.

Crop Progress. Prolonged droughts characterized a difficult growing season. Severe wilting, scorching and red rust occurred, particularly in the area south and west of the southern boundaries of the Angwa South, Trelawney, Banket, Umvukwes and Darwin I.C.A.s. The January drought in this general area was particularly severe, lasting as much as six weeks in some cases.

North and west of the line that has been quoted, conditions were much better and the area generally experienced one of the best seasons on record.

Due to the droughts the reaping season was delayed by up to a month and this in turn necessitated delaying the opening of the sales for approximately three weeks. Practically no tobacco was thrown away and the leisurely tempo of reaping enabled farmers to cope easily and adequately with this process and those of curing and suckering.

Topping was lower than in previous years and this fact, coupled with generally reduced plant populations and a dry season, contributed to the production of a high yielding crop which, however, exhibited a harsh feel and a higher proportion than usual of the darker tobacco grades.

Nicotine content, as a result of the drought, was much higher than normal and came in for criticism from the buyers.

Barns, Curing, Bulking and Grading. Management of the crop up to the reaping phase has reached a very high level. This progress has not been matched by improved standards in the handling, processing and manipulation of the crop after reaping. Handling facilities—barns, bulking and grading sheds—generally do not conform to the standard that is necessary for a crop as valuable as tobacco and curing itself lags behind in the general degree of improvement that has taken place in other directions. Too much bottom tier tobacco, amounting to approximately 25 million pounds weight, is spoilt because of scorching, "fixing green" and over conditioning. The loss in price caused by the above factors may mean the difference, to a farmer, between showing a profit or a loss at the end of the sales season.

The 30,000 barns in use in the country cured approximately 218 million pounds of tobacco in a particularly even and easy reaping season. Averages indicate that each barn cures about 6,000 lb. of leaf in a season. It would therefore appear that in a normal season the barn capacity could cope only with approximately 180 million pounds weight of tobacco. In a bad season it would be less than this figure. Such a state of affairs could prove a serious factor in the next crop, particularly in view of the marked tendency that has arisen towards the adoption of a single planting—in contrast to the practice of splitting the crop that was so popular a few years ago.

Bulking methods have shown improvement but by and large this phase of the crop is not properly organized and adequate records are not generally kept. Stick bulking of the entire crop was tried during this past season by a number of farmers with good results, but more information is required before the method can be critically commented on.

A disturbing feature of the crop has been the change in character of the tobacco during the period of bulking.

Tobacco which was bulked with a normal clear colour turned out to have a grey off-type colour when removed from the bulks. This condition was widespread and has caused grave concern because of the greatly depressed prices that were received for this type of leaf. It appeared to be more prevalent in those areas in which droughts were severest.

So-called off-type tobacco has been produced in large quantity and again this has been associated more noticeably with areas where the drought was severest although it was also generally noticeable that the true tobacco soils, despite severe droughts, produced smaller proportions of this type of tobacco than did less suitable soils.

Diseases and Pests. Generally speaking diseases and pests were not serious but the spread of Bushy Top virus and its early appearance in the season give cause for concern. All diseases were present but not in serious proportions.

Rotations. Grass continues to be the most popular rotation for tobacco although there are farmers, particularly in Lomagundi, who use the rotation tobacco/maize/tobacco/grass.

Second year land, particularly on the lighter sandy soils having a slight slope, is becoming more popular. Another practice is to plant tobacco on virgin land, allowing it then to lie fallow for a year before planting it to tobacco again in the third season, and after the crop has been reaped, establishing the land to grass.

A disturbing feature of the straight tobacco/grass rotation (even where nitrogen has not been applied to the grass) is that in some cases fertility levels appear to be rising with each crop of planted tobacco. This has necessitated late ploughing even those soils which should be early ploughed. Should this tendency prove to be widespread a modification of the present recommended methods may have to be considered.

Fumigations. The practice of fumigation of the land is becoming more wide spread and there is little doubt that it will become part and parcel of the recommended procedure for the production of tobacco. E.D.B. is generally preferred to D.D. Farmers are talking in terms of planting, for the sake of their cattle, Giant Rhodes and Star Grass instead of Katambora Rhodes and Love Grass in their tobacco rotation because they feel that, if fumigation is essential, they might as well use the most suitable grass for feeding to their stock.

Field Experiments. There were nine N.P.K. and two variety trials of flue-cured tobacco provided for in the Tobacco Research Board's experimental programme in both Southern and Northern Rhodesia during the 1959/60 season. Of these, four N.P.K. trials failed due to weather and because of technical reasons. Of the remainder two were of doubtful value, the balance being successful. The two variety trials were also successful.

An N.P.K. trial was conducted on Burley at Panmure.

General Remarks on Flue-cured Tobacco

(1) Despite severe droughts and generally trying conditions a record crop of 217,000,000 pounds was produced in the season under review. The most urgent need is to raise the general quality of the tobacco crop. Over-planting in relation to the barns available may be a serious problem in view of the fact that there are only approximately 30,000 barns in use and it is unlikely that more than 180,000,000 pounds weight can be cured in these barns for any one planting under normal conditions of ripening.

(2) Beef production on tobacco farms is increasing and provided tobacco farmers are able to finance both lines adequately there is no reason why they, the tobacco growers, should not play an extremely important role in the production of beef in the Federation.

(3) Mr. H. Squire, on secondment to Frasers and Associates and the Rhodesia Tobacco Association in connexion with the preparation of the manual of flue-cured Virginia tobacco production operations, continued this work with the addition of three trainees from the Department. The issue to field staff trained in tobacco of the completed manual on work study has now set the stage for the implementation of the findings that it contains.

Fire-cured Tobacco. None was grown in Southern Rhodesia during the period covered by this report. The crop has now ceased to be an economic factor in the agriculture of the Territory.

Turkish. Drought conditions, together with erratic rainfall during February and March, seriously affected the yield and quality of the crop. Late rains in April and May spoilt some of the curing tobacco but in general these rains proved beneficial. Yields varied from 400 lb. per acre to over 1,000 lb. per acre—which fact indicated the wide variation in the methods that were used and in the degree of attention particularly, that was given by farmers to the production of the crop.

Information already available on planting, reaping, curing and handling needs to be utilized and where the crop is grown it should be done properly if the desired results are to be obtained. Where the crop is left to labourers to manage without supervision results can only be bad.

Bushy Top virus seriously attacked the Turkish crop, particularly where it was planted after mid-January, and the disease generally is likely to be one of the most troubling features associated with the production of this type of tobacco in the future. Some compromise between the planting of flue-cured and Turkish tobacco must be found if both are not to suffer severely from this disease.

Good progress has been made by the Central Africa Turkish Tobacco Growers' Association in making it possible to collect factual information regarding the crop.

Burley Tobacco. Burley from the North-Eastern area sold well over the Limbe auction floors and returns have generally been good for the crop. However, the wide fluctuations in the price from season to season and the limited demand for the Nyasaland Burley type makes any long-term planning difficult and any expansion of the proportion of heavy bodied tobacco dangerous. The actual statistics relating to the crop are as follows:

	Weight in lb.		*Price per lb. in pence*	
	1959/60	*1958/59*	*1959/60*	*1958/59*
North-Eastern Region				
Burley	636,178	576,822	33.90	23.58

In Southern Rhodesia the crop was confined to experimental plots at Panmure and the tobacco was disposed of to a merchant. However, recently local representatives of an American firm have indicated that Southern Rhodesia Burley, as distinct from the Nyasaland product, is desirable. The demand is for the light fluffy type which it has been proved can be readily produced provided temperature and humidity are controlled during the cure. This control cannot be exercised except in barns of the flue-cured and fire-cured type. It should, however, be noted that the use of Burley in cigarettes is on the increase and it may well be that the world demand may exceed the present supply. If Southern Rhodesia Burley is satisfactory a definite opportunity exists for growers in this Territory to grow the crop in rotation with maize on the heavy soils which are scattered throughout the high rainfall areas but particularly in the Mazoe Valley, Banket and perhaps in the Hartley/Gatooma areas. At present it does not seem worth while for farmers to spend money on barns and other buildings for the crop but to use whatever is already available. There is no doubt that Burley of the right kind has a future and the opportunity should not be lost.

Very little Burley, apart from experiments at Trelawney and Panmure, is to be grown in Southern Rhodesia during the 1960/61 season.

Cigar Tobacco. It is some years since cigar tobacco was tried in the Federation but in 1959 small trial plantings of a number of varieties were made in the Melsetter area. This has been the effort of a private farmer and preliminary reaction on the Continent has been encouraging. Some 15 acres are planned for the 1960/61 season.

Cotton. This crop is slowly assuming a more important role in the Midlands—particularly in the Victoria lowveld—where its excellent potential under irrigation and good conditions of management were amply demonstrated during the past season. The use of the most up-to-date insecticides has been a key factor in making possible the high yields that have been obtained in this part of Southern Rhodesia and in the Sabi Valley. It is of interest to record here that on a certain privately owned estate in the latter area the average yield per acre under irrigation was in excess of 2,000 lb. On the Sabi Pilot Farm the average figure was almost 3,000 lb. per acre—truly a remarkable achievement.

In the Eastern Region slightly larger acreages were planted than in previous years but the average dryland yield was disappointing, being only about 300 to 400 lb. per acre. Early planted, supplementary irrigated cotton under good management grew out well and yielded up to 1,700 lb. per acre.

Apart from 60 acres that were grown in the Shamva area, cotton played a very unimportant role in Mashonaland during the 1959/60 season. It was of no significance in Matabeleland.

Castor Bean. Interest in this crop has disappeared almost entirely—only about 50 acres having been grown during the season. This acreage, in the Shamva area, yielded poorly.

Kenaf. No commercial production of Kenaf took place, all interest in it having disappeared since the closing of the fibre factory in Umtali.

It is reported that a good market for this fibre exists in the U.S.A. and it might well happen that farmers will once again develop an interest in Kenaf because of this fact. It has certainly been proved to grow well in the heavier soils under conditions of good rainfall.

Grass and Vegetable Seeds. In the Eastern Districts, very satisfactory crops of bean seed and satisfactory lettuce and tomato seed crops were produced during this past year. Small plantings of pea and bean seed under irrigation have taken place in the Victoria lowveld where conditions are ideal for this type of production. In the Mashonaland Region, particularly in the Salisbury Group, numerous farmers and small holders have developed an interest in flower and vegetable seed production generally.

Farmers are still feeling their way in this field of production.

Coffee. Two hundred and seventy-eight acres of coffee trees have already been planted in the Eastern Districts and seedbeds are established to make possible the planting out of a further 225 acres. The small crops that were harvested during this past year were sold locally.

A great improvement has taken place in the standard of management of the crop.

Tea. The total production of this commodity in the Eastern Districts during 1959 was 2,084,000 lb. off approximately 3,200 acres and this figure amounted to about two-thirds of Southern Rhodesia's requirement which, for that year, was in the vicinity of 3,500,000 lb.

There are now four large companies growing tea in the Eastern Districts but of these two are not yet in production.

Prospects for the future of this plantation crop appear to be bright.

Sugar. Further expansion in the acreage established to sugar-cane has occurred on Triangle Sugar Estate and on neighbouring farms, some 6,000 acres having now been planted to this crop in the Victoria lowveld. Additional development of sugar-cane production in this part of Southern Rhodesia will continue to take place for some time as and when water becomes available from Kyle Dam.

With large-scale irrigation of these shallow soils in the Chiredzi I.C.A. it is becoming increasingly apparent that some form of drainage is necessary.

Sugar-cane continues to be grown on a large company-owned estate in the Zambezi Valley.

Softwoods. It is in the Eastern Districts that softwoods play a dominant role in the rural economy, especially the steep mountain slopes where climatic conditions are ideal for this form of production. Most of the estates interested in softwoods in this part of the country are company-owned or leased—the acreage in this category under pine being 55,000. Twenty-seven thousand acres of pine are owned and operated by the Southern Rhodesia Forestry Commission.

Very little expansion in softwood production has taken place elsewhere in Southern Rhodesia during the year. An exception is the Selukwe Area where land has been purchased by a large organization for the purpose of supplying timber for processing into hardboard.

Wattle. Seventy-two thousand acres of wattle under the control of one large company are established in various parts of the Eastern Districts, being concentrated mainly in the Melsetter and Inyanga areas. All the wattle extract produced is exported, current production being about 13,000 tons per annum. The industry is not expanding.

(iii) *Fodder Crops.* Despite the fact that the acreage down to fodder crops remained substantially unchanged in the Midlands and Matabeleland Regions, the actual amount of hay and silage fed to cattle in these areas during the last winter was considerably higher than in previous years. This apparent anomaly was a result of the drought-ridden summer which compelled many farmers to conserve as fodder large acreages of maize and various legumes that had been intended as cash crops.

On most farms in the better watered parts of Southern Rhodesia where cattle are run, farmers are directing more and more attention to the making of hay and silage. One of the reasons chiefly responsible for this development is the great emphasis that has been placed upon this aspect of farming by those who have conducted the current Beef Production Drive.

Maize, sorghums and munga conserved as silage, legumes such as cowpeas and velvet beans as hay and dhal, jackbeans and winter cereals fed as green fodder crops, have all played an important part in helping to tide the livestock of the country over the long dry season. Special mention must be made here of irrigated lucerne in this regard. It continues to occupy an almost unique place in the economy of those farms where it is grown successfully and on a reasonable scale. There is no doubt that farmers are becoming increasingly aware of its value.

(c) *Livestock*

The past year has been the most difficult one for livestock farmers that Matabeleland has ever experienced and most of the Midlands, too, had an exceedingly difficult time because of the late arrival and erratic distribution of the rains. Elsewhere in the country reasonably good conditions prevailed for livestock producers.

(i) *Cattle:*

Beef cattle. Primarily because of the difficult season which necessitated the movement of thousands of head of stock away from Matabeleland, but also because of the stimulus provided by the great many Beef Discussion Groups that have been held throughout the country, there has been an unprecedented intensification of interest among farmers in beef cattle. Farmers are becoming more aware than ever before of the potential that is presented by this form of livestock husbandry. It is becoming increasingly accepted that to reduce mortality, increase calving percentages and obtain adequate weight gains, it is essential to provide supplementary feed during the long dry season. Weaning at the correct age, controlled breeding seasons, better handling facilities, the systematic use of preventative inoculations against diseases such as contagious abortion and quarter evil and of anthelmintics for the control of internal parasites, are all aspects of management in which marked improvement has been noted.

Cattle ranchers and farmers in all parts of Southern Rhodesia co-operated admirably with one another and with the Cold Storage Commission, the special Drought Relief Committee that was set up in Bulawayo, the various I.C.A. Committees and the Department of Conservation and Extension itself in their endeavour to overcome the effects of the drought in Matabeleland and the Midlands. Their united efforts, assisted by the late rains of April and May, averted what promised to be almost a national tragedy.

That the beef industry faces a bright future there is no doubt. Not only is there an assured market available for Rhodesian beef in the United Kingdom, but there is also a steadily developing demand for this product in the countries contiguous to the two Rhodesias. The rapidly growing population of the Federation itself constitutes an assurance that the local demand for beef will steadily develop.

Dairy cattle. Rising costs of production constitute a problem that confronts all dairymen, and marginal producers in particular are finding it increasingly difficult to make a profit. In an endeavour to preserve their standard of living many producers have increased the size of their herds, thus increasing the overall national level of production and the amount of milk that has to be diverted to industrial use for which a lower price is paid.

The Department is well aware of this particular problem. Through the medium of Dairy Discussion Groups and personal visits officers are making every effort to persuade dairymen to use all the means at their disposal to cut their costs of production. They are being encouraged to use more home produced feeds in preference to expensive bought concentrates, to cull poor producers and cows that do not calve regularly and to commence recording if this is not already done.

There is no doubt that only the really efficient producer will do well out of dairying in the foreseeable future.

(ii) *Sheep.* The year has been a reasonably good one for sheep and flocks are slowly increasing in both number and size in nearly all parts of Southern Rhodesia. It is principally in the Eastern and Mashonaland Regions that this increase is most apparent.

Blackhead Persian is the most common foundation stock but on a great many farms is being improved for mutton production by the use of Dorper, Wiltiper and Van Rooyen rams. Small flocks of Merinos and German Merinos are being run in the Eastern Districts and the latter breed is also to be found on a few farms in Mashonaland and the Midlands.

As a farming sideline there is a good future for mutton sheep in Southern Rhodesia provided that the standard of management is high.

(iii) *Goats.* There is little or no interest in this type of livestock, only a few flocks being kept for ration purposes.

(iv) *Pigs.* The present level of production is substantially the same as it was during 1958/59. As in the case of dairy producers it is those farmers who have reduced their production costs by growing their own feed that are doing well out of pigs.

Just sufficient pork and bacon are being produced in Southern Rhodesia to meet the country's requirements.

(v) *Poultry.* A slight increase in commercial egg production has taken place in Matabeleland but by and large the poultry position in the country is substantially unchanged from last year. The newly formed Poultry Breeders' Association should do a great deal to help the industry by establishing, through an inspection service in which the Ministry of Agriculture is co-operating, confidence among buyers in breeding stock producers.

Egg prices were comparatively low during the year.

(vi) *Fish.* No increase has taken place in fresh water fish production on farms in Southern Rhodesia and in the Midlands. In fact, it is considered that less netting is taking place now than was the case two years ago.

On a great many farms both small and large dams have been stocked with various varieties of *Tilapia* spp., but in the majority of cases netting is either not carried out at all or is done rather haphazardly. African labourers benefit, however, by being allowed to fish with rod and line. The amount of fish available for this purpose is adequate but regular supplies suitable for ration use could be ensured were ponds and dams to be managed more scientifically.

(vii) *Livestock Improvement Scheme.* As in the past this Department administered the scheme, numerous inspections being carried out by Conservation and Extension Officers and the Secretary of the Committee. Six meetings of the Committee were held during the year, the number of applications dealt with being 232, involving almost 300 bulls, approximately 70 cows and heifers and 42 boars.

A representative of the Dairying Branch of the Rhodesian National Farmers' Union joined the Livestock Improvement Committee during the middle of the year, increasing its number of members from six to seven.

In order to reduce the milk surplus, the Rhodesian National Farmers' Union requested the Livestock Improvement Committee to ban the importation of grade dairy stock except for certain specified breeds such as Ayrshire, Dexter and Brown Swiss. This request was duly met as from February, 1960, the net effect being a decrease of almost 300 head of grade dairy females imported into Southern Rhodesia compared with the previous year.

The Committee imported, on behalf of farmers, 75 sheep of various breeds of which the Dorper was predominant.

Details of these and of cattle imported on behalf of farmers are given below:

	£	s.	d.
Pedigree bulls (Friesland) 1 for	262	10	0
Grade females (Friesland) 14 for	808	0	0
Rams (German Merino) 1 for	36	0	0
Rams (Dorper) 29 for	453	0	0
Ewes (Dorper) 20 for	120	0	0
	£1,679	10	0

IMPORTATION OF CATTLE FROM THE REPUBLIC OF SOUTH AFRICA

The following male and female stock were imported from the Republic of South Africa either by the Livestock Improvement Committee on behalf of farmers or by farmers themselves:

	1.10.59 to 30.9.60	1.10.58 to 30.2.59	1.10.57 to 30.9.58
Pedigree Bulls —			
Ayrshire	1	2	—
Friesland	18	21	30
Guernsey	—	2	3
Jersey	14	16	17
Aberdeen Angus	3	1	1
Africander	90	102	196
Hereford	2	9	20
Shorthorn	4	1	3
Sussex	1	6	26
South Devon	2	2	5
Red Poll	—	5	5
Brown Swiss	2	1	7
Brahman	—	—	4
Dexter	—	1	—
Siemmenthalar	2	1	—
North Devon	—	1	—
TOTALS	139	171	317
Pedigree Females —			
Ayrshire	—	—	—
Friesland	45 plus 4 calves	47	29 plus 1 calf
Guernseys	—	9	16
Jersey	84	58 plus 3 calves	36 plus 4 calves
Africander	90 plus 4 calves	69 plus 14 calves	48 plus 6 calves
Sussex	—	—	16
Brown Swiss	9	—	12
North Devon	—	—	—
Red Poll	12 plus 2 calves	6 plus 1 calf	—
Hereford	12 plus 2 calves	—	40 plus 7 calves
Dexter	—	4 plus 3 calves	—
Siemmenthalar	—	3 plus 1 calf	—
TOTALS	252 plus 12 calves	196 plus 22 calves	197 plus 18 calves
Grade Females —			
Ayrshire	—	—	20
Frieslands	370 plus 7 calves	465 plus 17 calves	314 plus 1 calf
Jersey	168 plus 6 calves	232 plus 6 calves	225 plus 15 calves
Guernsey	—	—	8 plus 2 calves
Shorthorn	1 plus 1 calf	—	—
South Devon	—	—	—
Sussex	—	—	—
Dexter	—	7 plus 3 calves	—
Brown Swiss	—	12 plus 1 calf	—
TOTALS	539 plus 14 calves	716 plus 27 calves	567 plus 18 calves

Stock imported from the Republic of South Africa under special permits issued by the Republic Authorities:

	1.10.59 to 30.9.60	1.10.58 to 30.2.59	1.10.57 to 30.9.58
Pedigree Bulls —			
Aberdeen Angus . . .	—	—	1
Africander	7	—	5
TOTALS . .	7	—	6
Pedigree Females —			
Africander	99 plus 4 calves	—	—
Grade Bulls —			
Friesland	—	—	—
Africander	22	—	4
Santa Gertrudis x Africander	3	—	—
Africander (yellow) . .	2	—	—
TOTALS . .	27	—	4
Grade Females —			
Friesland	—	10	—
Africander (red) . . .	—	25	90 plus 85 calves
Africander (yellow) . .	28 plus 10 calves	20	—
TOTALS . .	28 plus 10 calves	55	90 plus 85 calves

Imported from Bechuanaland —	
Africander Pedigree	12 bulls and 2 cows
Africander Yellow	2 bulls and 6 cows
TOTALS	14 bulls and 8 cows

IMPORTATIONS OF CATTLE FROM UNITED KINGDOM

Importations of cattle from the United Kingdom during the year were as follows:—

	1.10.59 to 30.9.60		1.10.58 to 30.9.59		1.10.57 to 30.9.58	
	Bulls	Heifers	Bulls	Heifers	Bulls	Heifers
Ayrshire	—	—	2	2	—	—
Friesland	—	—	—	—	1	—
Jersey	2	2	2	3	3	9
Aberdeen Angus . . .	—	—	2	1	1	—
Hereford	1	—	1	—	2	—
Shorthorn	—	—	2	1	—	2
North Devon	—	—	—	—	1	—
Sussex	—	—	2	—	—	—
Red Poll	1	1	—	—	—	—
TOTALS . .	4	3	11	7	8	11

Cattle imported from other countries during the year were as follows:

Ex Holland	1 Friesland bull.
Ex U.S.A.	1 Hereford bull.
Ex Canada	1 Jersey bull.

Importation of Pigs. Two each of Welsh boars and gilts and one Large White boar were imported from the United Kingdom and the Union of South Africa respectively during the period covered by this report. Subsequent to the importation of the Welsh animals it was discovered that this breed of pig could not be registered in the Union Pig Stud Book due to the fact that in recent years Landrace blood had been introduced, thus making it unacceptable as a pure breed. Action is now being taken to prevent further importations of this type of pig

During the year visits to the country were paid by Inspectors of the Africander, Jersey and Friesland Breeders' Societies, all of whom worked in close collaboration with the staff of the Department during their tours of inspection.

5. PRODUCTION FROM IRRIGATION

(a) *General Progress of Irrigation*

Despite very serious water shortages in the Midlands and Matabeleland Regions, which reduced considerably the acreage irrigated this winter, the rate of expansion, excluding sugar-cane development, has been more than maintained during the past year and has amounted to an increase of approximately 10 per cent. over the figures for the previous year. In this regard the following table should be of interest:

	Acres Under Irrigation	
	1959	*1960*
Eastern Region	11,000	11,800
Mashonaland	10,000	10,700
Matabeleland	5,000	5,500
Midlands (excluding sugar-cane)	8,000	8,000
	34,000	36,000
Add acreage down to sugar-cane	7,000	9,000
Total for Southern Rhodesia	41,000	45,000

During the year almost 5,000 acres of new schemes were established of which 3,400 acres were in Matabeleland and the Midlands. Due to the water shortage in these two areas, however, their overall increase of land under irrigation was only about 500 acres. A greatly accelerated rate of expansion is almost certain to take place in the country as a whole during the next few years due, partially, to the large number of farm dams that have been constructed throughout Southern Rhodesia over the last twelve months. The water that will be made available to the Victoria lowveld from the Kyle Dam in 1961 should also play no small part in this anticipated growth.

(b) *Irrigation Officers*

After being vacant for a year the post of Irrigation Officer for the Midlands and Matabeleland Regions was at last filled in November, 1959—by an officer from within the Department itself. This officer is doing a great deal to assist farmers establish their irrigation projects on sound lines.

(c) *Training Courses*

Two intensive irrigation courses for members of the Department's staff were held, being attended by 22 field officers. In addition 14 short irrigation courses for farmers were held in various centres. These were popular, being attended by about three hundred farmers.

(d) *Major Schemes*

(i) *Umshandige.* Barley and wheat were the main crops grown under irrigation in this scheme during the 1960 winter, the acreage involved amounting to 760—almost exactly three-quarters of the total area that was under irrigation during the dry season. About seven hundred acres of various crops were given supplementary irrigation during the summer, maize constituting a substantial portion of this figure.

Approximately two hundred acres are now covered by sprinkler irrigation on various farms.

(ii) *Umgusa.* Most of the lands are now under sprinkler irrigation and dairying is the main farming activity.

(iii) *Coloured Settlers' Scheme, Mazoe.* The two good settlers are making some progress and are independent of any control. One of the participants in the scheme was removed as he was not proving a success; the position of the remaining two is precarious.

The small Committee which has supervised this particular project has been disbanded as it was no longer serving any useful purpose. The remaining settlers can still obtain extension advice from the local field officers of the Department.

(iv) *Que Que Irrigation Development.* Water has been allocated to farmers along the N'gesi river from the dam and several farmers are busy installing equipment, clearing land and preparing generally for the 1960/61 summer. About three hundred to four hundred acres are now ready for irrigation.

(e) *Large Private Schemes*

(i) *Triangle Sugar Estate.* Land clearing and its preparation for irrigation from the Kyle dam is still in progress. Yields have varied from 25 to 50 tons per acre but unfortunately the soil on some of the existing lands is shallow which cannot have a beneficial effect on the cane that is grown in them. It is generally stated that sugar-cane will grow on any soil and while this may be true, there is no doubt that good results are obtained only on the better and deeper soils.

(ii) *Hippo Valley Citrus Estate.* The citrus that has been established is growing extremely well but the main emphasis now appears to be on sugar. A block of land near the north-west corner has been cleared for cane and the site of the mill has been selected. Planting will begin as soon as water from the Kyle dam is available.

At present about six hundred acres under overhead irrigation are being planted to cane to provide planting material for the main block.

(iii) *Chirundu Sugar Estate.* One short visit was made to this particular estate by the Senior Irrigation Officer during the year. Problems concerning water application still exist but the management have called in their consultants to advise them on the best solution to these difficulties.

(f) *Sabi Development Farm*

On the whole the year was a successful one for the lessee.

In spite of severe setbacks to the maize crop due to a very heavy infection of streak disease, the final analysis of the year's operation should show that a reasonable profit was made. A total of 26 acres of maize, due to infection by streak, was ploughed in and planted to cotton; the remaining 26 acres, also seriously infected by the same disease, yielded only 240 bags of grain. Cotton proved to be the most successful summer crop, 42.5 acres being planted which yielded 2,742 lb. of seed-cotton per acre, most of which was graded as first class.

During the winter 83 acres of peas and beans were planted for seed production; except for some varieties of beans yields were not as high as had been hoped. Lucerne continues to grow extremely well the yields, so far, being above the anticipated average. Banana plants are making favourable growth but the transport of the fruit to the market constitutes a major difficulty.

Layout of the lands is proving satisfactory as is water application by the lessee. Lining of the canals is proceeding.

There seems little doubt that livestock will thrive in the Sabi Valley. The flock of sheep now numbers 200 and all the animals are in very good condition—as is the small dairy herd. The latter is not proving to be as profitable as the sheep due, mainly, to transport difficulties in moving milk and cream out of the area.

That the Development Farm is justifying its existence there is no doubt. A great deal of practical information is being obtained on all aspects of irrigation farming which should be of the utmost value to the further development of this area.

6. SOIL CONSERVATION

(a) *Arable Areas*

(i) *Mechanical Protection of Arable Land.* Good progress continues to be made in the protection of arable lands the need for which, it might be mentioned, is now accepted by the vast majority of farmers as basic to the wise utilization of the soil. Conservation Officers did a tremendous amount of pegging of storm drains and contour ridges during the year and very little of this effort was wasted through non-construction of the measures by the farmers concerned. Protection works, however, are not always constructed to recommended specifications and the breakages which inevitably result during heavy storms in these instances, necessitates the expenditure of a great deal of extra time and labour on their repair which could well have been avoided.

The following table indicates what has been achieved in the way of mechanical protection of arable lands:

Region	Period	Contour Ridges and Storm Drains (Miles)	Bench Terraces (Miles)	Irrigation Furrows (Miles)	Pasture Furrows and Veld Ripping (Miles)
Mashonaland	1955/56	3,312	1	52	1
	1956/57	3,327	2	21	—
	1957/58	3,137	1	41	7
	1958/59	3,356	—	24	—
	1959/60	3,528	—	37	—
Midlands	1955/56	737	5	33	412
	1956/57	703	13	36	24
	1957/58	760	2	22	5
	1958/59	754	6	40	62
	1959/60	708	2	34	24
Matabeleland	1955/56	104	12	11	14
	1956/57	158	1	11	—
	1957/58	395	9	21	—
	1958/59	350	2	13	1
	1959/60	309	2	22	2
Eastern	1955/56	1,555	12	39	2
	1956/57	1,558	10	56	2
	1957/58	1,818	9	54	—
	1958/59	1,664	5	34	3
	1959/60	1,484	—	63	—
TOTALS	1955/56	5,708	30	135	429
	1956/57	5,746	26	124	26
	1957/58	6,110	21	138	12
	1958/59	6,124	13	111	66
	1959/60	6,029	4	156	26

(b) *African Cultivation*

This problem is now a comparatively minor one in consequence of the concerted drive many I.C.A. Committees have made to bring it under control. Conservation Assistants under the supervision of Conservation Officers have made a significant contribution to this encouraging development.

Particularly farsighted has been the approach of the Mchingwe I.C.A. Committee in organizing, in its area, an African Tenants' Field Day and Show designed to stimulate, through competition, an interest among tenant labourers in sound land-use practices. This approach is a good one and has a great deal to commend it.

Co-operation on the part of the mission authorities in controlling indiscriminate cultivation on their farms has been excellent.

(c) *Roads and Railways*

Close co-operation continues to exist between this Department, the Rhodesia Railway authorities, the Department of Roads and individual road councils in matters pertaining to storm-water disposal and drainage. Conservation Officers, on occasions, are also called upon to advise on road alignment.

(d) *Grazing Areas*

(i) *General Management.* Because of the early cessation of the rains during the first few months of 1959 and their late commencement and erratic distribution during the 1959/60 summer, natural veld grazing in many parts of Matabeleland deteriorated to a degree that has rarely been seen in that area of the country. Unfortunately, by overstocking, a great many farmers intensified the problem, which reached critical proportions by early April, 1960. Late rains during that month and in May saved the situation, which was also helped tremendously by the movement of stock away from the drought-stricken areas. Farmers have undoubtedly learnt a bitter lesson from this experience, the effects of which will be felt for a long time to come.

The condition of the grazing areas in other parts of Southern Rhodesia at the end of the dry season is reasonably good.

Generally it may be said that there is still room for far more fencing and a great many more watering points throughout the Territory. The latter improvement, in particular, is of paramount importance if the beef industry is to prosper and the natural veld is to be used to best advantage.

(ii) *Veld Fires.* In contrast to last year, the winter of 1960 has witnessed a very small amount of indiscriminate veld burning. The reason for this was the poor growth made by the veld during the 1959/60 summer and the late rains of April and May which caused a green flush to develop at a time when uncontrolled grass fires normally commence.

A great deal of credit must go to the Natural Resources Board and the many I.C.A. Committees throughout Southern Rhodesia for their unremitting efforts, in diverse ways, to reduce the incidence of indiscriminate veld burning.

(iii) *Bush Encroachment.* This continues to be the most serious conservation problem in the country. In Matabeleland a series of veld management demonstrations are to start fairly soon to show farmers what can be done by biological means to control the spread of various species of bush, and in the higher rainfall areas a campaign to eradicate *Lantana camara* is being carried out. This particular invader is continuing to spread and in grazing areas constitutes a threat of no mean proportions.

In the Eastern Districts, aside from *Lantana camara* which flourishes in the area more luxuriantly than anywhere else in Southern Rhodesia, the plant *Caesalpinia decapetala* (Mauritius thorn) is fanning out steadily from Christmas Pass northwards towards the Honde Valley. It will be a very difficult task to bring this highly undesirable plant under control.

Farmers are becoming more and more aware of the magnitude of the problem of bush encroachment and the majority of them are conscious of the fact that, on their own efforts, in the final instance, will depend whether or not it is overcome.

(iv) *Fencing.* This particular aspect of farm improvement has received much attention during the past year, primarily because of farm planning and the increased interest being shown in beef production by farmers in all Regions.

By far the greater proportion of the fencing that has been erected has been used for the creation of additional paddocks.

7. WATER CONSERVATION

(a) *Dams Built under the Guidance of the Department*

The year has set a record both for the total storage capacity of new dams that have been built and for the number of dams that have been constructed. The early finish of the rains in 1959 and the drought during this last summer have shown the great need for more water conservation; these are, in fact, the major causes of the present tremendous increase in the number of dams that have been constructed. Farm Planning, however, has also played a most significant role in promoting this increase and the comparatively low operating costs and general efficiency of the new D7 crawler tractors being run by the Department in its dam building units has also contributed to the renewed demand for dams on the part of the farmers.

Details relating to all the dams built in Southern Rhodesia during the period covered by this report are contained in the following table:

Region	Period	No. of Dams	Aggregate Capacity in gallons	Average Capacity per Dam in gallons
Mashonaland . . .	1955/56	80	621,300,000	7,766,000
	1956/57	72	399,020,000	5,542,000
	1957/58	105	473,928,000	4,513,000
	1958/59	85	605,000,000	7,000,000
	1959/60	163	1,000,499,000	6,138,000
Midlands	1955/56	95	464,705,000	4,892,000
	1956/57	77	781,850,000	10,284,000
	1957/58	84	253,360,000	3,016,000
	1958/59	83	552,590,000	6,657,000
	1959/60	172	1,916,960,000	11,145,000
Matabeleland . . .	1955/56	153	527,300,000	3,450,000
	1956/57	142	679,200,000	4,783,000
	1957/58	133	832,000,000	6,631,000
	1958/59	208	1,435,630,000	6,902,000
	1959/60	389	2,279,000,000	5,833,000
Eastern	1955/56	25	34,700,000	1,388,000
	1956/57	20	100,565,000	5,028,000
	1957/58	39	23,600,000	605,000
	1958/59	37	103,000,000	3,000,000
	1959/60	54	269,650,000	5,000,000
TOTALS	1955/56	353	1,648,005,000	4,680,000
	1956/57	311	1,960,635,000	6,304,000
	1957/58	361	1,582,888,000	4,520,000
	1958/59	413	2,696,220,000	5,890,000
	1959/60	778	5,466,109,000	7,026,000

An analysis of the dams built by farmers and contractors, I.C.A. Committee units and Government units is given below:

Year	Farmers and Contractors		I.C.A. Committee Units		Government Units		Total No.
	No.	%	No.	%	No.	Total	
1955/56	130	36·9	84	23·8	139	39·3	353
1956/57	146	46·9	50	16·1	115	37·0	311
1957/58	253	70·1	42	11·6	66	18·3	361
1958/59	286	69·2	32	7·8	95	23·0	413
1959/60	585	75·2	18	2·3	175	22·5	778

(b) *Mechanical Units*

(i) *I.C.A. Units.* A gradual decrease in the number of I.C.A. units has been in progress for some time and at the end of September, 1960, only the machinery of the Bromley I.C.A. was left in operation. This particular unit has done a great deal of sterling conservation work over the years.

(ii) *Government Units.* There has been an exceedingly large increase in the demand for Government units which, had they been able to satisfy all the requests for dam construction, would have resulted in a substantially higher output of work in this field than was actually achieved during the year. As it is, the average number of productive hours performed by each tractor during the period covered by this report was far higher than that reached in the past.

A very large amount of selective bush clearing was also done by the Department's machines in the Chiredzi I.C.A. on behalf of the Director of Tsetse and Trypanosomiasis Control and Reclamation.

(c) *Catchment Schemes*

(i) *Bembesi-Inkwekwesi.* The chemical control trials on the highly erodible alkaline soils in this catchment are continuing and observations are made periodically.

(ii) *Umzingwane.* Conservation work in this catchment was finally completed during the year.

(iii) *Kyle.* A considerable amount of conservation work was carried out in this catchment during the year under the provisions of section 23 of the Natural Resources Act. Two small projects remain to be done and these, it is hoped, will be completed before April, 1961.

(iv) *Sebakwe.* Gully control and soil amelioration trials in the Mopani soil areas of the Bembezaan I.C.A. continued during the year, being augmented in number by further gully stabilization experiments that were established just before the arrival of the rains. This matter has been referred to in detail earlier in this report under the heading "Gully Control and Reclamation on Mopani Soils" in Section 7.

Certain minor Section 23 work was also carried out in this catchment during the year.

(v) *Odzani.* This Department is about to commence a land-use survey of this catchment and the information so obtained will be related to stream flow recordings made by the Hydrological Branch of the Southern Rhodesia Department of Irrigation. The effect of different land-use practices on stream flow will thus be determined.

(vi) *Sabi.* Work by the Sabi Planning Team in the Wye catchment was completed during the year and is now proceeding at a rapid tempo in another subcatchment of this large river system—that of the Condo.

8. FIELD TRIALS

No less than 107 field trials and demonstrations on various aspects of crop and animal husbandry and land-use were carried out in Southern Rhodesia by the staff of the Department during the year ended 31st September, 1960. Several of these were done at the specific request of the Department of Research and Specialist Services.

It is becoming increasingly apparent that the emphasis, in the case of field experimentation, should be laid on non-critical demonstrations rather than on critical trials which, by their very nature, demand a degree of care and attention that field officers are unable to give.

The following table analyses the distribution, on a regional basis, of the various trials and demonstrations that were supervised by this Department during the year.

Type	Matabele-land	Mashona-land	Eastern	Midlands	Total
Trash farming trial	1	1	—	—	2
Fertilizer demonstrations on general crops	7	2	5	6	20
Fertilizer trials on general crops . .	—	1	1	—	2
Trace element demonstration . . .	1	—	—	—	1
Drainage demonstrations	—	—	—	8	8
Pasture demonstrations	—	—	1	3	4
Bush control trials	1	—	1	4	6
Maize variety trials	—	1	3	3	7
Cotton variety trials	1	—	1	4	6
Soya bean variety trial	—	2	—	—	2
Gully control and soil amelioration trials	1	—	—	5	6
Wheat trial on moisture retaining soil	—	1	—	1	2
Kenaf variety trials	—	2	—	—	2
Sugar-cane demonstration	—	1	—	—	1
Lucerne fertilizer trial	—	1	1	—	2
Livestock feeding trials	2	—	—	—	2
Fruit and vegetable trials	—	—	6	—	6
Fodder crop demonstrations . . .	13	1	—	6	20
Tobacco fertilizer trials	—	3	3	—	6
Tobacco variety trials	—	2	—	—	2
TOTALS	27	18	22	40	107

9. ADVISORY SERVICES

(a) *Visits Made by Officers of the Department*

Purpose of Visit	Mashona-land	Matabele-land	Midlands	Eastern Districts	Total
Pegging —					
1. Contours	1,884	101	447	729	3,161
2. Storm drains	45	15	45	10	115
3. Grass strips	79	1	12	13	105
4. Other (pasture furrows) .	252	8	52	36	348
5. Roads and road drains .	225	19	64	71	320
6. Irrigation works . . .	76	57	116	71	320
7. Dams	849	882	688	397	2,816
TOTALS	3,410	1,083	1,424	1,327	7,185
Inspections —					
1. Subsidy	106	159	116	23	404
2. Water Court	159	37	105	194	495
3. Roads	124	13	62	26	225
4. Timber cutting . . .	6	2	6	5	19
5. Land settlement and Crown land	86	42	59	12	199
6. Subdivision of land . .	73	21	21	42	157
7. Seed	8	3	4	7	22
8. Livestock improvements .	126	36	53	45	260
9. Livestock — other . .	299	181	270	99	849
10. Mechanical units . . .	1,086	474	372	145	2,077
11. Miscellaneous	452	152	446	193	1,243
TOTALS	2,525	1,120	1,514	791	5,950
Advisory —					
1. Field crops	1,986	189	1,029	659	3,863
2. Veld and pasture . . .	65	96	109	35	305
3. Livestock	681	723	502	136	2,042
4. Irrigation	133	170	478	56	837
5. Conservation	897	258	574	299	2,028
6. Farm planning . . .	2,413	403	1,040	554	4,410
TOTALS	6,175	1,839	3,732	1,739	13,485

Purpose of Visit	Mashonaland	Matabeleland	Midlands	Eastern Districts	Total
Meetings —					
1. I.C.A. and Group	546	299	359	213	1,417
2. Farmers' Association meetings	165	60	98	74	397
3. Staff	302	99	170	123	694
4. Miscellaneous	477	128	113	144	862
TOTALS	1,490	586	740	554	3,370
Other Visits —					
1. Research stations	205	74	89	81	449
2. Farmers days	419	63	236	209	927
3. With committees	171	92	185	200	648
4. With specialists	495	153	282	280	1,210
5. Miscellaneous	1,787	395	518	365	3,065
6. Field trials	338	116	366	396	1,216
TOTALS	3,415	893	1,676	1,531	7,515
GRAND TOTALS	17,015	5,521	9,086	5,895	37,517
GRAND TOTALS . 1956/57	12,791	4,446	10,171	7,977	35,385
1957/58	14,089	4,921	8,202	6,801	34,013
1958/59	12,227	5,086	8,461	6,374	32,148
1959/60	17,015	5,521	9,086	5,895	37,517

The increase in the number of visits made in the Mashonaland Region is of considerable significance, illustrating the greater demand for advice and other services which has resulted from the increase in the number of farmers and the general progress that has been made in agriculture. This trend appears in other statistics including the production of many agricultural products. Because of this and administrative difficulties serious consideration is being given to the division of Mashonaland into two regions.

In general there would appear to be an insignificant increase in the visits made over the last four years. It must be explained that the Department realized that the demand was becoming out of hand and in consequence introduced the system of Farmer Discussion Groups that has been explained in more detail in Section A. While the total number of visits has not become very much greater the advice given has increased considerably.

(b) *Farmers' Days, Courses and Discussion Groups*

In the four regions over 450 field events were held during the period under review. The tendency has been to concentrate on the smaller discussion group and two- to three-day courses; by using these methods more advanced technical advice has been communicated than would otherwise have been possible. The discussion groups have enabled the staff to contact more farmers with less travelling and the benefit of a wider range of ideas and opinions has been conferred on those who have attended.

African tenant farmers were invited to field events in several areas as well as to the specially organized field day that was held for them in the Mchingwe I.C.A.

Touring teams of specialists dealt with beef and tobacco, the two subjects which received extra attention during the year. Courses dealing with the problems of irrigation, beef and milk production were organized in the regions and were well attended. For further information on this aspect please refer to 5 (c).

The I.C.A. committees who work in close co-operation with the Department's staff are, of course, largely responsible for the success achieved during the year in this particular field.

(c) *Agricultural Shows*

The Department's exhibits at the ever growing number of shows were of an even higher standard than in previous years, but a publicity or information officer could, were he made responsible for co-ordinating the general effort in this direction, effect a further improvement.

Officers of the Department acted as judges, stewards and served on the show committees.

While the quality and quantity of the farmers' exhibits were by and large of a high standard, it was disappointing to note the apathy of the tobacco farmers. The number of tobacco exhibits at the Salisbury Show were less than at some of the district shows.

(d) *Conservation Field Visits for Teachers*

A general awareness of the problem of the conservation of the natural resources of the country must be instilled into the children and this is the responsibility of the teachers. The Department, together with the Natural Resources Board, can give the information to the teachers to pass on to the children and has employed one-day field visits by teachers and children to good effect during the year. The majority of these conservation outings were very successful.

The Matabeleland Conservation Education Committee was formed during the year to foster, organize and generally co-ordinate conservation education in that part of Southern Rhodesia.

(e) *Conservation Week*

Due to careful planning and the enthusiastic support of a great many schools, Conservation Week in 1960 was extremely successful in every way. The theme "The Importance of Water" was a fortunate choice and aroused no little interest. Teachers co-operated admirably in communicating the conservation message to their pupils and the standard of the models, friezes, diaries and work-books produced by the children was of a high order.

10. FARM PLANNING

Progress in farm planning this year has not come up to expectation, due to a number of factors. These factors include:

- (i) The general drought conditions that prevailed in many parts of the country.
- (ii) The beef production drive with its attendant emphasis on livestock visits and field days.
- (iii) The movement of drought relief cattle from Matabeleland to Mashonaland.
- (iv) The increased emphasis on water conservation in both the high and low rainfall areas of the country.
- (v) The introduction of 23 new Conservation Officers into the field this year.
- (vi) Considerable staff changes due to resignations, promotions, tobacco training, etc.
- (vii) The fact that the more progressive farmers in the country have now had their properties planned. (Twenty-five per cent. of the total number.)

Farm planning figures on a regional basis for this year with comparative figures (in brackets) for the previous twelve months are given below:

	Completed	*Being worked on*
Mashonaland	176 (232)	172 (143)
Midlands	116 (169)	165 (141)
Matabeleland	57 (82)	46 (29)
Eastern	44 (83)	46 (42)
Sabi Team	47 (65)	26 (14)

The acreage of land which has been *classified* during the twelve months covered by this report is as follows:

Mashonaland	518,216
Midlands	539,510
Matabeleland	722,551
Eastern	186,002
Sabi Team	170,065

The output of farm planning and land classification over the past four years is reflected in the following grand total since the inception of the new Farm Planning procedure.

Number of farms planned	1,357
Number of acres classified	5,485,444

These figures represent approximately 23 per cent. of the European-owned farms in Southern Rhodesia.

The following figures reflect the progress that has been made since planning under the new system started:

Year ending 30th September, 1957	68 plans produced
Year ending 30th September, 1958	218 plans produced
Year ending 30th September, 1959	631 plans produced
Year ending 30th September, 1960	440 plans produced

Planning Section records have been vastly improved by the introduction during the year of running totals registers showing the number of farms planned, stage progress data, and acreages from the starting date of the farm planning scheme under the photographic system. The compilation of these registers was a major task.

11. EXPERIMENTAL FARMS

(a) *Karoi*

A major policy change was made with the sale of the dairy herd which had fulfilled its purpose in demonstrating the production of milk and butterfat in conjunction with a pig enterprise in a remote area. In the future emphasis will be placed on the production of beef which is more in keeping with present demands and the locality of the farm.

(b) *Chipinga*

The establishment of a farm liaison committee which includes local farmers, has increased public interest in the farm which continued with its normal programme during the year.

These farms continue to serve a useful purpose in demonstrating to the landowners in the surrounding areas a balance system of mixed farming with special attention to the problem of integration of the various lines of production.

C. NORTHERN RHODESIA

1. ORGANIZATION

During the year ended 30th September, 1960, no changes were made in the organization of the Department which continued to function efficiently in all its branches.

(a) *Head Office*

Apart from a few small matters which are now receiving attention, the administration section has generally proved satisfactory. The registry has, however, suffered from sick and vacational leave casualties and a certain amount of reorganization is required. It is hoped that towards the end of the year the trained staff will be available to build up this section to match any in the Service.

(b) *Intensive Conservation Areas*

Apart from two or three farms at Mwinilunga, a few at Abercorn and some other individual isolated farms, the European areas of Northern Rhodesia are now covered by the I.C.A. organization. The Mumbwa I.C.A. has amalgamated with the West Chisamba I.C.A. so as to have closer liaison with farmers on the line of rail.

The present position in regard to Intensive Conservation Areas is as follows:

(1) Declared during the year—nil.
(2) Investigated or under investigation for declaration—nil.
(3) Sub-divided during the year—Chilanga I.C.A.
(4) Investigated or under investigation for subdivision—nil.
(5) Boundaries changed—nil.
(6) Investigated or under investigation for boundary changes—Lusaka north.
(7) Declared to date in Northern Rhodesia—Details are given below:

Group	*I.C.A.*
Zambezi	Livingstone Zimba (South Kalomo) Kalomo North Choma South Choma North
Mazabuka	Monze-Pemba Magoye Lower Kaleya Upper Kaleya Mazabuka Nega Nega
Lusaka	Chilanga East Chilanga West Lusaka West Lusaka East Lusaka North
Chisamba	Chisamba East Chisamba West Mwomboshi Mumbwa.
Broken Hill	Broken Hill South Broken Hill North Mkushi
Copperbelt	Chingola-Bancroft Ndola-Luanshya Kitwe-Mufulira
Fort Jameson	Fort Jameson

(c) *I.C.A. Committees*

In general, the I.C.A. Committees are running efficiently and, except in a few cases, their enthusiasm during the year has been most commendable. Closer liaison and contact has been achieved with the Committees this year by the Department's staff, and this has created an atmosphere of mutual goodwill. Better use is now being made of the ward system and there is no doubt that progress is much better in those I.C.A.s in which it has been established and valuable information and news of local interest to the farming community is being disseminated through this medium.

(d) *Group Organization*

The Group Organization is now functioning better than before, there being only one area remaining where it has not fulfilled its proper role.

2. STAFF

During the year there were a number of staff changes. Mr. C. K. Thompson was promoted to the post of Deputy Director of Conservation and Extension, Salisbury, while Mr. R. H. Fitt was appointed to the vacant post of Regional Director in Lusaka.

Mr. Maitin, who resigned from his post of Irrigation Extension Officer, was replaced by Mr. G. D. Goldthorp.

Two Group Conservation and Extension Officers decided that they wanted to devote their time to the practical side and have resigned from the Department to become tobacco farmers.

Mr. Francis, who was appointed to the new post of Poultry Officer, has travelled extensively and made contact with all the poultry farmers.

Conservation Officer Mr. de Jong was transferred to Southern Rhodesia, while Conservation Officer Mr. Harris resigned to obtain further qualifications in the United States. New Conservation Officers are Messrs. Ranger, Edwards and Platford.

The establishment has been increased by a Conservation Officer for Mkushi and an additional Relief Officer.

The above promotions and resignations have necessitated a number of transfers which it is felt will help to strengthen the service. Nevertheless, it is appreciated that such transfers are upsetting to local I.C.A. Committees and, therefore, an endeavour is made to keep them to a minimum.

Mr. J. W. Hayward, Group Conservation and Extension Officer, has been transferred to Broken Hill but, due to the difficulty of a suitable replacement in Kalomo, he will remain there temporarily until an officer trained in tobacco can replace him.

Mr. Milligan recently completed his tobacco training and will, after completion of his leave later in the year, take up his appointment in Broken Hill as Conservation and Extension Officer.

The vacant post of Group Conservation and Extension Officer in Fort Jameson is to be filled by an experienced officer, Mr. H. Snook. He moved to this area in October.

The staff position on the Experimental Farms is now satisfactory.

The post of Mechanical Engineer was readvertised without success.

Generally it may be said that the staff position has been satisfactory but certain committees have complained that they have to share officers or that the Department has not had adequate numbers of relief staff to fill the places of officers who have been away on leave. Replacement during leave periods is difficult but the additional post will assist to reduce this problem.

At long last it has been possible to assist Choma with a relief officer and a member of the Planning Team, and it is hoped that the Department can make a substantial inroad into the backlog of pegging that exists in this area and complete more regional plans than was at first envisaged.

The following table gives the establishment of the Department in Northern Rhodesia:

	Authorized 1.7.56	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
Head Office —				
Regional Director	1	1	1	1
Regional Conservation and Extension Officer	1	1	1	1
Senior Animal Husbandry Extension Officer (seconded from Department of Research and Specialist Services)	1	1	1	1
Senior Tobacco Extension Officer .	1	1	1	1
Senior Conservation Engineer . .	1	1	1	1
Irrigation Officer	1	1	1	1
Horticulturist (seconded from Department of Research and Specialist Services)	1	1	1	1
*Poultry Officer (seconded from Department of Research and Specialist Services)	2	1	1	1
Soil Chemist (seconded from Department of Research and Specialist Services)	1	1	1	1
Economist	1	1	—	—
Higher Executive Officer	—	1	1	1
Administrative, Executive and Clerical Officers	5	6	6	6
Stenographers	2	2	2	2
Senior Executive Officer	1	1	1	1

*Previously shown as "Dairy/Poultry Officers". Now one Poultry Officer, while Dairy Officer reverted to Department of Research and Specialist Services).

	Authorized 1.7.56	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
Planning Team —				
Planning Officer	—	1	1	1
Conservation Officers	—	2	2	2
Agricultural Topographers . . .	2	2	2	2
Field Staff —				
Additional Regional Conservation and Extension Officer	—	1	1	1
Group Conservation and Extension Officers	9	8	8	8
Conservation Officers	18	18	18	18
Animal Husbandry Officer (seconded from Department of Research and Specialist Services)	1	1	1	1
Experimental Farms —				
Managers, supervisors and Assistants	7	7	8	8
Carried forward . .	56	60	60	60

	Authorized 1.7.56	*Authorized 30.9.59*	*Authorized 30.9.60*	*Requirements*
Brought forward	56	60	60	60
Working Account — Accounts Staff —				
Higher Executive Officer (seconded from Ministry)	1	1	1	1
Clerical Officers (seconded from Ministry)	—	2	2	2
Stores Officer	1	1	1	1
Engineers, Supervisors and Mechanics —				
Senior Mechanical Engineer	1	1	1	1
Senior Mechanical Supervisor	—	1	1	1
Mechanical Supervisors Mechanics	Variable according to volume of work from time to time.			
Branch III —				
Tracers	—	—	—	2
Survey Assistants	11	14	14	14
Clerks	5	6	6	6
Branch IV —				
Senior Agricultural Capitao	1	1	1	1
Agricultural Capitao	4	4	—	—
Orderly	1	1	1	1
Telephone Operator	1	1	1	1
Field Survey Orderlies	21	25	29	30
Handyman	1*	1	—	—
Bricklayer	1	1	1	1
Driver	1	1	1	2
Other Posts (ungraded) —				
Eurafrican Assistant	1	1	1	1
Orderlies	3	3	3	2
TOTALS	110	125	124	127

*Post abolished.

(a) *Visits to Other Countries*

Please refer to "A. General."

(b) *Departmental Committees*

The Regional Director and/or Regional Conservation and Extension Officer served on the following committees during the year:

(i) Committee to investigate the System of Financing European Farmers (member).
(ii) Farmers Debt Adjustment Board (member).
(iii) Agricultural Lands Board (member).
(iv) Eastern Province Loans Co-ordinating Committee (member).
(v) Tsetse and Trypanosomiasis Committee (member).
(vi) Natural Resources Board (advisory).
(vii) African Affairs Sub-committee of the Natural Resources Board.
(viii) Education Sub-committee of the Natural Resources Board (member).
(ix) Drainage Sub-committee of the Natural Resources Board (member).
(x) Regional Planning Sub-committee of the Natural Resources Board (member).
(xi) Bush Encroachment Sub-committee of the Natural Resources Board (member).

The Senior Tobacco Extension Officer served on the:

Eastern Province Loans Co-ordinating Committee (member).

The Senior Animal Husbandry Extension Officer served on the:

(i) Livestock Improvement Committee (chairman).
(ii) Livestock Improvement Board (member).

Other committees and boards on which officers served were:

(i) Regional Planning Sub-committee of the Natural Resources Board—Regional Conservation and Extension Officer and Planning Officer (advisory).
(ii) Water Board of Northern Rhodesia—Senior Conservation Engineer and Irrigation Officer (advisory).
(iii) Southern Rhodesian Sabi Catchment Technical Advisory Committee—Planning Officer (member).

(iv) Copperbelt Lands Advisory Committee—additional Regional Conservation and Extension Officer (advisory).

(v) Northern Rhodesian Irrigation Development Committee—Irrigation Officer, Planning Officer, Regional Conservation and Extension Officer.

In addition to these, officers attended meetings of the provincial teams in certain Provinces and the Natural Resources Sub-committee of Provincial Teams, meetings of councils and commodity committees of the Northern Rhodesia Branch of the National Farmers' Union and have assisted the committees of various Agricultural show societies.

(c) *Conferences*

The Regional Director attended the 7th Meeting of SARCCUS held in Nyasaland.

3. TRANSPORT

The present arrangement whereby most officers use their own transport continues to be satisfactory.

In regard to departmental transport certain replacements have been made and the position is also satisfactory, but further new vehicles will be required in the next financial year.

4. EXPENDITURE

Vote 41	Northern Rhodesia	1959/60		1960/61 Authorized and Anticipated Expenditure
		Authorized	Actual	
B	Subsistence and travel	7,410	5,658	6,340
C1	Books and periodicals	70	42	70
C2	Camp equipment	100	89	360
C4	Leave entitlements	920	609	600
C5	Office and miscellaneous	1,740	1,716	1,960
C6	Purchase and upkeep of technical equipment	280	275	685
C7	Recruiting expenses	—	—	—
C9	Water, Light and sanitation . . .	130	84	110
—	Post and telegraph charges	—	—	—
E1	Conservation works and measures .	1,400	1,338	1,750
F	Conservation Working Account . .	500	282	500
G1	Chalimbana Experimental Farm . .	5,140	5,133	6,175
G3	Copperbelt Experimental Farm . .	7,060	6,524	7,815
G5	Mochipapa Experimental Farm . .	5,310	4,665	5,450
G6	Msekera Experimental Farm . . .	4,640	4,738	5,850
H	Transport and equipment	24,150	23,105	25,150
	TOTALS	£58,850	£54,258	£62,815

5. GENERAL AGRICULTURAL CONDITIONS

(a) *Climatic Conditions and General*

The year under review has been a difficult one for dryland crop production due to very erratic rainfall conditions. Despite the difficult season, yields of tobacco and maize have been generally satisfactory. It is considered that this position can in no small measure be attributed to the employment of better techniques and that if a similar season had occurred a few years ago the results would have been less favourable.

Rainfall conditions varied throughout the country and, in some areas such as Mazabuka and Kalomo, varied considerably on adjoining farms. Early showers fell about the middle of November in many areas, but this was followed by a prolonged dry period till the middle of December when rain, amounting to between 8 inches and 20 inches, fell in the form of the cyclone "Coleen". General rains then continued to fall in most parts of the territory from the Kafue River northwards, and in the Mkushi area were very heavy indeed. South of the Kafue River and in the Eastern Province prolonged dry spells occurred from which many farmers felt, at one stage, their crops would not recover.

Rainfall totals ranged from 14 inches in Kalomo to 60 inches at Mkushi. During the winter months some heavy unseasonal falls occurred which damaged hay crops and Turkish tobacco.

(b) *The Financial Position*

(i) *The Farmers' Debt Adjustment Board.* Advising the Farmers' Debt Adjustment Board and the farmers who are under the Board's jurisdiction has been one of the most important and difficult problems that the senior members of the staff in Northern Rhodesia have had to undertake. A considerable amount of their time and effort have been devoted to this work. It was largely as a result of advice given by the Department that the Board called for more detailed investigations into all the farmers' affairs in order that long-term plans could be produced. The new system of budgeting will greatly assist this type of planning and it is hoped that the results will show a great improvement over the next few years.

(ii) *Fort Jameson.* The two Governments concerned who have been working together over the past few years had hoped to have a tenant farming scheme introduced and envisaged that the first tenants on the land would produce a crop in 1960. However, due to various reasons the scheme has not been implemented yet but it is hoped that further progress will be made in this connexion in the near future.

The Eastern Province Loans Co-ordinating Committee continued to deal with loans for farmers in the area. The past season, although it at one stage did not look very promising, has turned out reasonably well and only a few farmers were unable to repay their current loans. Some of them had good results and were able to repay a proportion of their back debts.

Members of the Eastern Province Loans Co-ordinating Committee visited the Eastern Province during the year and contacted the majority of the farmers in the area.

The Department is convinced that Fort Jameson has a good potential and can play an important part in the country's agricultural economy. The results achieved by some of the farmers in the area have shown conclusively that this opinion is sound and is not based only on theoretical values. Unfortunately, the area has been given a poor reputation by those who did not do so well during the period prior to the last few years.

(iii) *Livingstone.* When the Federal Government took over the responsibility of providing agricultural extension advice to European farmers, a high level investigation was carried out in the Livingstone I.C.A. The two Governments have worked very closely together ever since and have given assistance and guidance to those in the area who needed it. The Agricultural Lands Board of Northern Rhodesia, on the advice of the Department of Conservation and Extension, changed the boundaries of the farming units to ensure that the individual holdings would be economically sound. The size of a holding was based on an assessment of the land's capability and its productivity to ensure that a sufficient volume of output could be obtained. The Northern Rhodesia Government through its Cattle Loan Scheme, and the Cold Storage Commission through its Grazier Scheme, have given assistance in putting more livestock on to the farms. Regional Planning has resulted in a big improvement in the water resources of the area and if finance for fencing under Regional Planning could have been made available it would have helped considerably. The Northern Rhodesia Government, through the Land and Agricultural Bank of Northern Rhodesia, has made loan funds available for the development of this area. With the increased production of flue-cured tobacco on the Kalahari sands and the assistance mentioned, the situation has altered considerably in the Livingstone area and good progress has been made. The Northern Rhodesian Government has also been investigating the question of a further loan to the Livingstone Dairy for the installation of a pasteurizing plant. Recently an appraisal was made of the current situation and the two Governments have taken steps to provide further assistance and guidance. The Livingstone I.C.A. need no longer be termed a problem area.

(iv) *Committee to Investigate System of Financing European Farmers.* The above-mentioned Committee sat under the chairmanship of Mr. Swan, Director of the Veterinary Department; the then Regional Director of the Department of Conservation and Extension, Mr. C. K. Thompson, was also a member. The "Swan Report" was eventually submitted to the Government.

(c) *Crop Production*

(i) *Food Crops:*

Maize. Despite a difficult season, yields of maize have been reasonably satisfactory. Some farmers in the maize growing areas, however, especially a section in the Mazabuka Group, had poor yields due to prolonged dry periods. The total acreage planted was similar to that of the previous season.

Although techniques have generally improved over the last few years, there are certain items to which more attention should be given. Proper deep ploughing at the correct time is still not evident on many farms and unless more attention is given to this aspect, the effect of other sound practices, such as good stands and proper fertilizing of the crop, will be nullified. The ploughing back of organic matter, whether in the form of green crops, maize stover or grass, is still not being carried out sufficiently, and until this matter is rectified, yields per acre will not increase to any appreciable extent. The draining of lands which have a wetness factor is being continually undertaken, but much still remains to be done. Many farmers are becoming conscious of the need to have their soils tested to enable proper fertilizer recommendations to be made and are also finding that the "pH" in some instances is low—revealing the need for lime applications.

Southern Rhodesia hybrid No. 12 was used for the first time by many farmers and good yields have been reported. Its degree of resistance to Helminthosporium is not as high as was anticipated.

Sorghums. The "Framida" variety of sorghum was grown in the Mazabuka area during the year. It was planted about the middle of January and yielded approximately 12 bags per acre of good K2 Red quality grain. There is a demand for more of this K2 Red type of sorghum, but the response by the farmers has not been forthcoming.

Groundnuts. Only a very limited quantity of groundnuts was grown and supplies were fully used for ration purposes on the farms. Officials from the Federal Ministry of Agriculture and the Grain Marketing Board toured the country with the object of creating interest in this crop and giving advice on methods of production. Definite interest has been created and it is felt that during the next few years increased production will take place.

The new "Mt. Makulu" strain of seed which has shown great promise in the central zone of Northern Rhodesia is being bulked up and will be available for commercial planting on a limited scale next year.

Potatoes. The production of potatoes has dropped this year. The summer crop produced in Northern Rhodesia was sufficient to supply only about one to one-and-a-half month's domestic consumption. The early winter crop was also slightly under-produced and did not meet the demand.

From investigations carried out it is obvious that Northern Rhodesia growers supplied only about three-quarters of the potatoes consumed last year. It is hoped that the newly formed Northern Rhodesia Potato Marketing Board will play a major role in sorting out the many uncertainties which, in the past, have made potato production a very unpredictable venture.

Wheat. The latest figure for the total acreage of wheat grown in Northern Rhodesia is 1,061 acres. Of this total, 479 are irrigated by means of overhead spray and 653 by flood irrigation. Although the largest acreage of any crop under irrigation, wheat has a low gross income per acre. More often than not wheat lands are fallow during the summer and over the years soil deterioration has occurred. With new varieties and better irrigation techniques, yields of over 10 bags per acre can be achieved, which will make wheat a more profitable crop to grow, but the overall net income, unless a cheap source of water is available, will not be high.

Vegetables. The 1959/60 season was highly favourable for vegetable production and disease control measures showed extremely good results. Good supplies throughout the year were obtainable but the quality of the product still left a great deal to be desired. However, the quality of the produce supplied direct to the consumers is far superior to that retailed through the markets and shops.

An official from the Division of Economics and Markets paid a visit recently to Northern Rhodesia to investigate the local marketing problems.

Citrus and Sub-Tropical Fruits. Citrus is still the most important fruit crop of Northern Rhodesia. Plantings of young trees are continually being made, the main planting period being July and January. To date there are approximately 75,000 citrus trees established in the country. Reasonable prices are being paid to the producer and the African market is proving a satisfactory one with a demand that is steadily increasing.

Greater attention is being focussed on the production of bananas, particularly in the West Lusaka area. Parts of Northern Rhodesia, especially the Lusaka, Chisamba and Broken Hill areas, where cheap irrigation is available and frosts are not severe, have considerable potential for further banana expansion. Northern Rhodesia imports more than 90 per cent. of its requirements and farmers could, therefore, expand their output, especially in the areas mentioned, because the gross return per acre is more profitable than many other lines of production.

The production of avocadoes, pawpaws, pineapples and granadillas is mainly centred around Lusaka. Avocadoes and pawpaws are over-supplied during the period January to April, but fruit produced out of this season still finds ready markets.

(ii) *Cash Crops*

Tobacco—flue-cured

The season where flue-cured tobacco was concerned was very variable but overall the results have been satisfactory and the crop has sold well.

Seed-beds. Seed-bed management has been good, though too many first sowings are made two weeks too late to allow good hardening-off to be done; this mistake is slowly being rectified. Mulch is universally used, though the technique needs improving. Methyl bromide is growing in popularity and about 50 per cent. of the sites are treated. Watering faults still give rise to the major problem of cupping and retarded growth. The standard of hygiene is generally fair.

Diseases of seed-beds such as frog-eye were prevalent, while anthracnose showed a decline in incidence during the season.

Land Selection. The subject of land selection has received much attention, but it could still benefit from more detailed soil survey. In Northern Rhodesia most of the crop is grown on virgin land which is late ploughed. However, many lands when stumped are shown to contain two differing soil types.

Land Preparation. Most lands were late ploughed and the consequent difficulty of obtaining a good tilth was experienced by many farmers. With the prolonged drought in November and early December, the dryness of late ploughed soil showed up in depleted stands.

Fertilizers. Fertilizer applications were generally reasonable. Over Northern Rhodesia as a whole the pH levels in the subsoils tend to be low.

Planting Out. There was virtually no planting out before early November, about 80 per cent. of the crop being established during this month. Fort Jameson was once again behind the rest of the country largely because there are insufficient farmers in that area equipped with water carts.

The use of insecticides in planting water was general.

Crop Progress. The early planted tobacco which had established good roots came away well with the rains in December and stood up to the subsequent January drought. Tobacco planted with the "set in" rain was severely hit by the January drought, though it made a remarkable recovery in February when more rain fell. Topping was generally done at a reasonable height but often on the late side. The ripening was very slow, and barn accommodation was adequate. It was a big extension problem to convince farmers that they should hold on and not reap certain lands. About five per cent of the crop was planted in late January (in Fort Jameson this amounted to about 20 per cent.) and remained free from aphis; where sufficient rain fell in March it did well right through the sales.

Overall, the crop is expected to average out at between 800 and 850 lb. per acre—approximately the same as last year.

Barns, Curing, Bulking and Grading. Barn space was adequate, but this was due to the slow ripening of the crop and not to the spacing. More barns are being built, but it is felt that there will be a corresponding increase in the acreage. There is also considerable improvement in existing barns, furnaces and other equipment. Great interest centres on the Shiloh floor, one of which is installed at Mochipapa.

There was a marked increase in the number of farmers doing their own grading, and consequently storage and grading facilities have improved.

Curing was relatively easy, very little slatey and sponged leaf being produced.

Diseases and Pests. The overall incidence of these was slight, with frog-eye and alternaria being the most prevalent diseases. Barn spot was fairly common.

Aphis attack was very slight, and rosette and curly top, though evident in all areas, was limited to odd plants.

Destruction of plants was difficult and relatively inefficient owing to the late rains.

Rotations. Rotation of crops is not generally practised yet as most farms are still in the development stage. However, in the longer settled areas such as Choma, the planting of improved pastures is becoming general. It is usual to follow tobacco with maize and then allow the land to revert to grass.

Turkish Tobacco. There has been a revival of interest in Turkish and Northern Rhodesia can claim to have a producer who grows over one hundred acres. The early cessation of the rains caused the crop to hang in to the lands. General disappointment was expressed at the Samsoun prices offered, but there was general satisfaction with the Soluk prices. The crop was grown satisfactorily, but common mistakes were over-ripe reaping, over-curing and over-exposure. Also, few growers gave the necessary attention to the leaf on the racks, and tobacco was not opened up as it should have been.

It is likely that the acreage grown will increase so it is of great importance that the local growers should organize themselves and register as producers.

Burley. The North-Eastern Rhodesia crop has done very well indeed, and the proposed acreage for 1960/61 will be about 30 per cent. above the 1959/60 figure. Prices realized have been as good as or better than those that were obtained for flue-cured. Burley can play a major part in rehabilitating the red soil areas of North-Eastern Rhodesia if good market conditions continue to prevail. There is, however, always some uncertainty as to the stability of the market.

Seed Production. The progress in this field has not been as great as was expected due to various reasons. It is considered that more detailed investigatory work will have to be done in connection with the techniques of growing and handling the crop, varieties to be employed and soil and fertilizer requirements before any real progress can be made.

There are five seed potato growers in Northern Rhodesia producing mainly up-to-date seed tubers of "B" grade.

Vegetable and seed production is being carried out on 17 farms in Northern Rhodesia, the acreages varying from 1 to 25 acres in each case. Peas form the main crop. The variety Greenfeast No. 422 yielded the best results giving over one ton per acre; other varieties were erratic in yield. Railage costs of £5 per ton are a deterrent to pea seed production.

Grass seed production has not expanded to any extent due mainly to the limited market available. If this seed could be exported economically and proper services provided, production would no doubt increase. The appointment of a permanent seeds officer for Northern Rhodesia would help very much to facilitate matters in connection with seed production.

(iii) *Fodder Crops*

In the previous annual report it was stated that more attention was being given to the production of fodder crops. However, apart from certain individual farmers, the production of fodder crops has not come up to expectation. Leguminous crops such as velvet-beans, jack-beans, soya-beans and cow-peas are usually planted too late to give any satisfactory yields. Two farmers in the Chisamba area planted soya-beans on a fairly large scale and reaped 4½ bags of seed per acre. The spacing between the rows was not close enough, however, and competition from weeds was a problem.

A noticeable increase has taken place in the planting of dhal for winter grazing. Farmers who have seen beef cattle grazing this legume have noticed the good condition of these animals and are now convinced of its worth. Dolichos lablab (seed imported from India) has shown promise on a farm in the Bemba area where it has been used for hay and as aftermath grazing for beef steers.

Protein rich crops which can be *economically produced* on the farm using the correct techniques, will play an increasingly important role in dairy and beef production. In this category are species such as lucerne, dhal, dolichos and possibly jack-bean.

With greater emphasis being placed on beef production, it is essential that reserves of fodder should be available for livestock during the dry months.

(d) *Livestock Production*

Due to the early cessation of the rains in 1959, the condition of livestock by the end of the year, especially in the southern portion of the territory, was poor and a number of farmers lost stock through lack of feed. The overall position has since improved and livestock generally are in good condition.

(i) *Cattle:*

Beef Cattle. This past season has surely indicated to everyone concerned the tremendous potential for beef production that exists in Northern Rhodesia. Farmers everywhere are improving their methods of management, feeding and handling and the indications are that Northern Rhodesia is on the threshold of what may almost be called a new era in stock-farming. The Department has been helping and will continue to assist as far as possible in an endeavour to raise general standards of production. Beef courses for farmers were held during the year in Chisamba and Kaloma and, in addition, extremely successful beef discussion groups were arranged throughout the country. Fifty of these have already been held with an attendance of approximately 600 farmers. Items covered have consisted mainly of marketing policy, livestock policy, veld management, breeding, feeding and the grading of beef on the hoof and on the hook. Next year further discussions will be held during which more emphasis will be placed on the veterinary aspect.

The Cold Storage Commission, which commenced operations in Northern Rhodesia during the year, should be of great assistance to the livestock industry. Grazier recommendations are now being dealt with through the Rhodesia National Farmers' Union.

Due to the drought in Southern Rhodesia last year, some 6,000 head of stock were brought in from Matabeleland by the Cold Storage Commission in addition to large numbers by private agreement. Apart from a few losses these animals are doing reasonably well.

It is noticeable that a great increase is taking place in the supplementary feeding of breeding cows and young stock and it is encouraging to report that in the last six months some 24 farmers have purchased cattle weigh-bridges. A greater number of farmers are feeding cattle this year and have been very well satisfied with the grades and prices received. It is estimated that throughout the country approximately 5,000 head have been fed or slaughtered this year for sale from August to December. With this tremendous interest being shown in beef production there is a big demand for cattle, especially for young steers. However, breeding stock are also needed to ensure the overall increase of the country's livestock population.

Dairy Cattle. This was again a record year for milk production, even though there had been a long dry winter followed by rather erratic rains during the growing season. Poor leguminous crops affected the winter feed reserves to a marked degree and it is still apparent that many milk producers are *not providing adequate good quality farm grown feeds to meet their normal dry season requirements.* Even though the increase in milk production has not been as marked as in previous years, production has exceeded demand and the disposal of the surplus in the manner to give a producer a satisfactory return for his product has constituted a difficult problem.

There are now 169 registered farm dairies in the territory. During the course of the year 11 producers dropped out and 10 new producers commenced operations. There are 26 registered producer retailers, the majority of whom are situated on the Copperbelt.

The operation of the semi-official milk recording scheme continued during the year but dairymen have not taken advantage of it as was anticipated. Only two new herds have entered the scheme whereas eight herds have dropped out due to a variety of reasons.

Sheep. A much greater interest is being shown in sheep and during the year numerous small flocks were started. Dorper sheep are beginning to play a more important role now and a steady increase in the sheep population should take place.

Pigs. A survey of pig producers in Northern Rhodesia was recently carried out at the request of the Pig Co-operative which is concerned about the decline in pig production. The industry in Northern Rhodesia received a setback in 1958 as the result of the restrictions on credit facilities, the closing of the factory in

Lusaka at very short notice and the non-availability of cheap feed. At present, local producers are providing only 60 per cent. of Northern Rhodesia's requirements and one-fifth of them are producing 80 per cent. of the pigs marketed.

Poultry. During the period covered by this report more attention was given to poultry production in Northern Rhodesia than in the previous year and a permanent poultry officer is now stationed in the territory, having been seconded from the Federal Department of Research and Specialist Services.

There has been a general improvement in the overall management of poultry but much still has to be done in this direction—housing and ventilation in particular being very important subjects of extension work. The poultry population is increasing in the North, mainly on the Copperbelt and in Lusaka. Reductions in flocks continue to take place in the Southern Province.

The production of table birds has been very greatly improved and increased in regard to quality and quantity respectively. Table birds constituted an important subject in the year's work and besides extensive advisory effort and field days, a stand at the Kitwe Show also dealt with this particular aspect of poultry production.

There has been no appreciable increase in the country's laying flocks and except for the short flush season, September to November, the supply does not meet the demand. The off-season supply period can be improved if the farmers obtain their chicks later on.

Good Cattle Production Bounty. A total of 263 farmers applied for the bounty during the year ended 30th June, 1960, and of these, 238 were approved. The total sum paid out amounted to £28,086, a decrease in comparison with the previous year due to the fact that some farmers failed to comply with the regulations governing the Good Cattle Production Bounty Scheme and also to the fact that few applications were received. There is no doubt that this scheme has helped considerably in bringing about better management of livestock in the country.

Livestock Improvement Scheme. This Department continued to administer the scheme with the advice of the Livestock Improvement Committee. Owing to the availability of good quality breeding stock in the Federation, there were few importations from the Republic of South Africa. Essentiality Certificates were issued for importations of the following:

Pedigree bulls	119 head
Pedigree beef females	87 head
Pedigree dairy females	61 head
Grade dairy females	50 head
Pigs	10 head
Sheep, pedigree rams	5 head
Horses	8 head

Applications for grants under the Livestock Improvement Scheme numbered 85, of which 75 were approved—involving an expenditure of £3,839. Grants were approved on the following livestock:

Pedigree bulls	91 head
Pedigree females	38 head
Grade bulls	70 head
Pedigree sheep	12 head
Pedigree rams	1 head

The 25 per cent. rebate on rail charges was continued and a total payment of £72 was made. The Livestock Improvement Committee was not called upon to make any purchases for the farming community.

6. PRODUCTION FROM IRRIGATION

Owing to the resignation of Mr. Maitin, the Irrigation Officer, at the end of November, 1959, Northern Rhodesia was without the services of a specialist in this field for six months.

(a) *Progress of Irrigation in Northern Rhodesia*

During the year there was a steady increase in the development of new irrigation schemes and, in addition, extensions and consolidations to old schemes took place. Apart from the Kafue Pilot Polder however, very expensive irrigation development is notable by its absence. Few farmers are interested in laying out large sums of capital which will take several years to redeem.

(b) *Potential for Irrigation*

There is obviously a vast untapped irrigation potential in Northern Rhodesia and, apart from the potential major schemes which must rely upon large works for impounding big quantities of water, there are many small schemes already in existence which can be expanded without the necessity of constructing extra storage works. Out of the 157 schemes covered by a recent irrigation survey, 87 have water supplies which are not being fully utilized. In addition to these schemes there are many potential schemes not covered by the survey. Many dams have already been built and impound water which could easily be employed for irrigation. Also, the natural flow of rivers and streams is not by any means fully harnessed.

(c) *Crops which Could be Grown in the Future*

Although the crop with the largest acreage under irrigation is wheat, it is more than likely that this is so because of the fact that it is a quick, easy-to-grow cash crop. Because of its low gross income per acre it is not popular. The crop with the second largest acreage is vegetables which, despite the erratic marketing conditions which prevail, will remain popular. The production of potatoes has dropped this season and the summer crop produced in Northern Rhodesia is sufficient to supply only about one to one and a half months' consumption.

Citrus and other fruits occupy well over a thousand acres. The increased earning power of the African, particularly on the Copperbelt, is one factor which might encourage greater production of this commodity.

The acreage under lucerne is nowhere near sufficient to satisfy the requirements of dairy, beef and pig producers. Considering the dairying industry alone, it is vital that every producer should reduce his cost of production and this can be done, if irrigation is available, by producing lucerne as a cheap form of protein feed. In addition to dairying, there is a large scope for increased beef production. Adequate lucerne grown on the farm would help beef producers show a greater profit and increased rate of turnover. This unrivalled fodder crop has more or less unlimited scope for expansion.

Where maize production is concerned it is obvious that very much greater acreage of this crop could be supplementary irrigated—if necessary at the expense of wheat which, under present circumstances, is nowhere near as good a financial proposition.

There is also further scope for the supplementary irrigation of tobacco as there are already a number of growers who have purchased the necessary equipment.

(d) *Main Problems Encountered*

Many schemes, both flood and overhead, have not been properly designed in their initial stages. A number of farmers selected overhead layouts without making certain that the rate of precipitation was suited to the soil's infiltration rate, and in some cases, also, the effects of wind have not been given sufficient attention.

The majority of flood schemes have been given little thought in regard to their design and there is a big need for greater use to be made of the land plane in all the irrigation areas of Northern Rhodesia.

Information is needed by both field staff and farmers on the economic aspects of irrigation and the Irrigation Officer has commenced preparing details on this subject.

The newly formed Northern Rhodesia Irrigation Development Committee will be a great help in making available information on the various aspects of irrigation.

7. SOIL CONSERVATION

(a) *Arable Areas*

(i) *General*. In regard to the mechanical protection of the Territory's arable areas, progress was satisfactory in some parts of the country, but in others this all important work has not received sufficient attention for various reasons, one of which is the priority being given to regional planning.

A total of 128,000 yards of storm drains, 860,000 yards of contour ridges, 306,500 yards of roads and 45,000 yards of waterways were pegged during the period under review. The yardage of storm drains constructed is similar to that of the previous season but it must not be forgotten that this is only the first line of defence and that the normal contour accompanied by good farming on these lands is essential.

Last year stress was placed on the need for careful land selection. Since then, it has been applied on an increasing scale but there is still a long way to go before all farmers appreciate the value of a soil pit and the services that the pedologists can render. Looking into the soil is more important than looking at the soil.

Emphasis on the need for the continual incorporation of organic matter into the soil either by grass leys, green crops or ploughing back crop residues must continue to be made.

(ii) *Mechanical Protection of Arable Lands.* Due to the work being done on regional planning the amount of pegging work carried out during the period covered by this report is about the same as for the previous year. Northern Rhodesia, however, is a relatively flat country and, apart from certain sections such as Choma and Kalomo, more attention is being given to drainage work rather than to anti-erosion measures.

The following table illustrates what has been accomplished in the sphere of mechanical protection work:

Group		Contours Distance (in yards)	Storm Drains (in yards)	Roads (in yards)	Waterways (in yards)	Irrigation Furrows (in yards)
Copperbelt/Broken Hill		45,838	3,826	154,710	1,000	3,820
Chisamba		52,774	29,226	21,540	10,090	1,800
Lusaka		161,557	45,553	48,940	17,788	14,066
Mazabuka		31,765	17,650	7,640	1,600	2,650
Choma		338,084	—	32,940	13,740	—
Kalomo		144,556	1,000	37,220	800	—
Fort Jameson		85,571	982	3,520	—	—
TOTALS	1959/60	860,145	98,237	306,510	45,018	22,336
	1958/59	754,322	135,634	301,600	63,843	39,526
	1957/58	1,175,373	100,673	399,144	50,283	102,618
	1956/57	913,700	133,800	149,200	—	—

This side of the work had to be restricted in order that the regional plans could be completed as soon as possible—hence the decrease in output.

In addition to the above-mentioned works, 8,851 acres of land were laid out according to conservation principles. Of this total, 5,700 acres were stumped for farmers by the mechanical units of this Department.

(iii) *Roads.* Steady progress is still being made on getting good roads properly sited. This aspect is considered absolutely essential to the proper working of the farm and due recognition is given to this aspect when areas are regionally planned. A total of 170 miles of farm and district roads were realigned or surveyed in the case of new roads, during the year.

(iv) *Drainage.* Ridge and furrow layouts have proved very successful and during the year were established on 5,749 acres, an increase of 2,391 acres over the previous year.

Further drainage schemes under regional planning are being implemented in the Molendemo area which adjoins the area where a regional plan was planned and implemented successfully last year, and the Magoye area where severe flooding from the Ngwezi River takes place. The very flat area of land adjacent to the Great North Road in Chisamba has now been surveyed and planned and it is hoped to implement this plan in the near future. The other problem areas of East and West Chisamba have also been dealt with successfully under regional planning.

Individual farm drainage is still a serious problem but techniques of survey have expedited the production of plans for drainage and it is anticipated that this work will continue to make rapid progress.

(b) *Grazing Areas*

(i) *General Management.* With the emphasis now being placed on livestock production, it is essential that proper veld management should be carried out. Bush encroachment continues to increase and apart from the uncontrolled veld fires late in the year which do tend to assist in controlling this problem, little progress is being made in halting its speed. The Bush Encroachment Commitee of the Natural

Resources Board is pressing for more experimental work to be done in this connexion as there are, besides Lantana, other shrubs such as Chinese Lantern (Dichrostachys) and Royena, which are slowly spreading in many areas.

Ring barking of the larger trees causing them to die within two to three years has been successful and it is possible that large acreages can be dealt with in this manner giving increased yields of dry matter per acre.

More and more fencing has been erected and better distributed water supplies have been established, but proper management of the veld within the paddocks leaves room for very much improvement.

(ii) *Veld Fires.* As usual, this menace still remains, but with increasing interest being taken in stock, farmers are really making an effort to conserve one of the most valuable natural assets, namely grass.

8. WATER CONSERVATION

The following table shows particulars of dams built in the various Groups during the year:—

	Farmer Built		*Government Built*	
Group	*No.*	*Capacity*	*No.*	*Capacity*
Kitwe/Broken Hill	1	9,000,000	6	100,000,000
Chisamba	1	250,000	5	28,750,000
Lusaka	2	30,000,000	4	20,250,000
Mazabuka	2	1,500,000	5	23,500,000
Choma	2	3,000,000	4	116,000,000
Kalomo	—	—	22	223,500,000
Fort Jameson	1	3,000,000	—	—
TOTALS 1959/60	9	46,750,000	46	512,000,000
1958/59	12	61,750,000	26	275,000,000
1957/58	17	59,290,000	41	103,000,000
1956/57	10	22,080,000	47	114,886,000

	Total Number of Dams Constructed	*Capacity (gallons)*
1959/60	55	558,750,000
1958/59	38	336,750,000
1957/58	58	162,290,000
1956/57	57	128,966,000

(note the trend to larger and hence more economical dams)

During the year 55 dams were built with a total capacity of 558 million gallons. This is a big improvement over last year when only 38 dams with a total capacity of 336 million gallons were constructed. A very large percentage of these dams have been built under the Regional Planning Scheme. More dams for stock watering are essential as farmers cannot increase their carrying capacity unless water supplies are well distributed. Farmers should be encouraged to supplement these dams built under the Regional Planning Schemes with others.

9. MECHANICAL UNITS

(a) *General Remarks on Staff*

The European staff position is more stable and, except for the loss of a welder, is very much more satisfactory than it has been for many years. The African staff position is also good, a high standard of conduct and efficiency amongst the men having been maintained.

The new bonus scheme introduced last year for supervisors has proved most effective, and a similar one has been submitted for Africans. A similar type of inducement for mechanics would be highly desirable, but no suitable scheme has yet been evolved.

(b) *Report on Tractor Groups*

(i) *Equipment*

12 Caterpillar D7 Tractors.
1 Caterpillar No. lw motorized grader.
7 No. 70 scrapers.
7 Rippers.
3 Bush-clearing chains.
3 Tree dozing stingers.
1 Low-loader.
6 Lorries.
Plus minor equipment and light transport.

During the year, one D7 tractor and an Adams grader were boarded and replaced by a new D7 and a Caterpillar No. 12 grader respectively. To cope with the volume of work on the tsetse control programme in Southern Rhodesia, the tractor fleet has been temporarily increased by two D7 tractors.

(ii) *Work Done.* The most important development during the year was a £72,000 bush-clearing project in the Sabi Valley done (for the Southern Rhodesia Working Account) on behalf of the Department of Tsetse and Trypanosomiasis Control and Reclamation. Five D7 tractors, plus transport and ancillary equipment were sent down. Work is still in progress on this project. The output, both of working hours and cleared acres, has so far been outstanding.

Extensive bush-clearing was also carried out in the Mkushi project, and for private applicants in Kalomo, Zimba, Choma and Chisamba.

Regional planning dams, storm drains and roads were constructed as projects in the Maramba, Mazengula, Sibanyati, North Kalomo, Upper Kaleya, Upper Chongwe, Lusito, Bowood and West Molendemo Regional Plans. All these works have been executed most successfully and reflect great credit on the planners and the construction staff.

(iii) *Workshops.* The Workshops' staff have done sterling work throughout the year. In spite of the replacement of old tractors by new machines, the large increase in output has resulted in a heavy volume of work, particularly in the field, for mechanics. The loss of the welder has thrown an added burden on to the remaining men but they have responded well.

(iv) *Analysis of Working Hours.* (This analysis is given for the period 1st July, 1959, to 30th June, 1960, to coincide with the Working Account Financial Years.)

Working hours increased by 5,700 hours over last year's figure, to give the highest output ever recorded by the Working Account; this figure amounted to 66 per cent. of available working hours. The tractors and the one grader averaged 152.5 hours per machine-month, compared with last year's figure of 117.2.

This improvement has been brought about by an increase in the hours of overtime worked by supervisors, and also by an all-round increase in efficiency.

The breakdown of hours is as shown below, with last year's figures given in parentheses:

Normal available working hours		29,460 (26,940)
Overtime hours		3,940 (2,595)
Gross available hours		33,400 (29,535)
Less servicing hours		3,030 (3,318)
Net available hours		30,370 (26,217)
Hours worked = 20,113 (14,418)		66.3% (55.1%)
Hours lost		
Moving	1,610 (1,783)	5.3% (6.8%)
Unserviceable	5,115 (5,369)	16.7% (20.3%)
Weather	1,844 (1,064)	6.1% (4.1%)
Awaiting work	293 (2,090)	1.0% (8.0%)
Other causes	1,395 (1,493)	4.6% (5.7%)
	10,257(11,799)	33.7% (44.9%)

It will be noted that both the percentages and totals of hours lost have been reduced under every heading except that of "Weather".

The figures speak for themselves, and reflect credit on all Working Account Staff—supervisors, mechanics and Africans and, in particular, on the Senior Mechanical Engineer. Credit is also due to the professional field staff of the Department whose co-operation and assistance have been invaluable.

(v) *Financial Statement.* For the first time on record the Working Account has succeeded in showing a profit, the figure for the year ending 30th June, 1960, amounting to approximately £1,500. While this figure is comparatively small, it must be mentioned that a new system of raising depreciation charges was introduced during the year, resulting in an additional sum of about £23,000 compared with last year's figures, being set aside for the purchase of new equipment.

As last year's losses amounted to £20,500, there is thus an improvement of £45,000 reflected in the present year's operation.

In the first year under the Federal Department the loss was in the region of £40,000 to £50,000.

(c) *General Remarks*

The hopes expressed in last year's report that the Working Account would now be on a sure footing have been largely realized.

The position for the coming year is to some extent clouded by the lack of regional planning funds to finance the increased work potential of the units. Nevertheless, up to the end of September, each month shows a constant increase in output, and if sufficient work can be obtained, a very healthy profit should be achieved.

10. FIELD TRIALS

Field trials and demonstrations continue to form an important part of the functions of the Department. However, the policy is to carry out the more detailed trials involving statistical work on the experimental farms and to *demonstrate* research findings on the normal farms in co-operation with the farmers and the I.C.A. committee in each case. In some cases, unfortunately, this critical, detailed work cannot be done due to experimental farms being situated out of the environment where the information is required; where these circumstances prevail the experiment concerned has to be done in close co-operation with the farmer.

The following trials and demonstrations were carried out during the 1959/60 season:

Maize variety trials	5
Maize fertilizing trials	3
Groundnut variety trials	3
Soya-bean variety demonstrations	4
Soya-bean fertilizing trials	2
Irrigated winter pasture demonstrations ...	2
Urea feeding demonstrations	2
Potato variety trial	1
Ridge and furrow demonstrations	3
Summer vegetable trial	1
Dhal variety trials	4
Pea seed trial	1
Turkish tobacco trials	2
TOTAL	33

Flue-cured Virginia tobacco and Burley tobacco trials were also carried out in conjunction with the Tobacco Research Board.

The trials this year have been, on the whole, very successful and useful information has been collected which will be disseminated to all concerned. In the coming season a greater range of trials and demonstrations will be carried out, including further groundnut variety and fertilizer experiments in various areas and a series of trials on maize root worm in the Monze-Pemba I.C.A.

11. ADVISORY SERVICES

(a) *General*

Due to the difficult financial position of many farmers, a great deal of advice on the economic aspect of farming is being given to various Departments of the Northern Rhodesia Government and other bodies such as the Co-operative Societies, the Agricultural Lands Board and the Land and Agricultural Bank.

It is encouraging to be able to state that field officers of the Department have built up a good reputation among the European farming community at large and that a most cordial relationship has developed between them.

(b) *Visits made by Officers of the Department*

Meetings and Courses Attended

		1958/59	*1959/60*
1.	I.C.A. and group committees	353	347
2.	Farmers' associations	98	61
3.	Road boards	28	16
4.	Staff—Groups and regional	149	158
5.	Agricultural Lands Board	32	17
6.	Young Farmers' Clubs	61	31
7.	Miscellaneous	383	281
8.	Natural Resources Board	54	56
9.	Land Board	—	27
10.	F.D.A.B.	35	79
11.	Courses	—	85

Inspections and Visits

		1958/59	*1959/60*
1.	Regional planning	857	626
2.	Other conservation subsidies	74	52
3.	Water Board	41	69
4.	Agricultural Land Board	233	338
5.	Livestock Improvement Scheme	250	509
6.	Cattle Bank	16	65
7.	Dairy bonus	12	1
8.	Land Bank	55	23
9.	Seed Association	66	117
10.	Tobacco grading sheds	82	41
11.	Pest control	117	14
12.	Miscellaneous	827	446
13.	Visits with committee members	125	109
14.	F.D.A.B.	—	378
15.	With V.I.P.s	—	305

Advisory

		1958/59	*1959/60*
1.	Regional planning	1,220	981
2.	Farm planning	200	137
3.	Extension	2,235	2,138
4.	Pegging	603	721
5.	With Irrigation Officer	129	69
6.	Irrigation layouts	105	156
7.	Mechanical units	518	518
8.	Experimental stations	372	301
9.	Field days	292	310
10.	Road boards, etc.	48	98
11.	Tobacco advisory	2,520	1,636
12.	Miscellaneous	719	351
	Totals	12,909	11,667

Totals 1956/57: 6,492; 1957/58: 10,315

(c) *Field Days*

The usual normal large-scale field days have been held throughout the country. It is not through this medium, however, that it is felt the Department can make the greatest contribution to the farming community. The small discussion groups which are now held on such subjects as maize, tobacco, irrigation, beef and poultry are of great value, and it is through this approach that the Department will continue to extend its activities. The beef discussion groups have been outstandingly successful and have helped tremendously in the drive for more and better beef. Dairy discussions will be commenced shortly and items such as recording, management, feeding and culling will be looked into by farmers and members of the Department.

A total of 181 field days and discussion groups were held with an attendance of 3,804, compared with 176 field days and an attendance of 3,058 in the previous year.

(d) *Shows*

The Agricultural Shows this year on the Copperbelt, in Lusaka and in Livingstone were generally better supported than last year. Of special note were the slaughter stock classes on display. The Department did well, winning prizes at Lusaka and Livingstone for their stands. All exhibitors deserve to be complimented and will be urged to even greater effort next year.

(e) *In-service Training*

The Additional Regional Conservation and Extension Officer returned from a study tour in the United States and Europe. The Senior Animal Husbandry Extension Officer is on a similar tour at present and will, without question, return with many new ideas to help in the beef drive. Two officers of the Planning Team attended a course in Delft, Holland. Further details concerning these visits are contained in Section A.

Normal short courses were held for the Department's staff and visits to the Research Stations in Southern and Northern Rhodesia were also undertaken. The following courses were attended by members of the staff:

Irrigation Course ...	12 Officers.
Beef Course	10 Officers.
Time and Motion Course	5 Officers.

In addition, a Planning Course for members of the Department of Agriculture, Northern Rhodesia Government, was run by officers of the Department in Lusaka.

Three officers underwent tobacco training and two of these concentrated, by special arrangement, on time and motion studies.

(f) *Teachers' Courses*

The Educational Sub-committee of the Natural Resources Board, in co-operation with the Department, organized a full programme of one-day courses throughout the Territory. After holding a few of these courses it was decided that a different approach was necessary to create an interest among teachers in the importance of conservation, and periodic visits to the schools by members of the Educational Sub-committee during the afternoons and in the evenings were consequently arranged and undertaken. The talks that they have given and the discussions which have resulted will, it is hoped, engender renewed interest in the subject of conservation among the teachers in Northern Rhodesia.

One-day field trips, it should be stressed, have by no means been abandoned in favour of the new approach.

(g) *Young Farmers' Clubs*

This organization is now being sponsored by the Natural Resources Board who have an officer seconded from the Agricultural Lands Board to act as full-time organizer and the movement is progressing steadily. There are now 19 clubs affiliated and 21 on probation, making a total of 40 clubs. Nearly all of them have participated in the various agricultural shows and their activities are now expanding. A Club Leaders' Conference was held during the year.

The Senior Young Farmers' Club in Lusaka is making good progress and has held a number of interesting discussion groups.

(h) *Provincial Administration Courses*

After the course on Natural Resources which was held for senior members of the Provincial Administration last year, it was decided to hold further courses of this kind for all members of the Provincial Administration. A week's course was held during the year at the Monze Development Centre and 14 officers attended. The Department assisted in the course and gave lectures on such subjects as regional planning, erosion control and natural factors affecting agriculture and soils. Further courses are being organized on similar lines.

12. PLANNING

(a) *Regional Planning*

Considerable progress has been made and the Department has been able to produce a substantial number of plans. Unfortunately there have been insufficient funds to implement them all. Up to September, 1960, 33 plans had been prepared, of which 12 were prepared from September, 1959, to September, 1960. The overall position is given in detail in the following schedule:

PLANS COMMENCED DURING THE 3-YEAR EXPERIMENTAL PERIOD ENDING 30TH JUNE, 1957

Area and Plan Name and Number	*Acreage*	*Commencement Date*	*Completion Date*
Upper Kaleya (Upper Kaleya/2)	7,728	1. 6.54	31. 5.58
Upper Kaleya (Middle Kaleya/4)	57,884	1. 6.54	31. 5.58
West Lusaka (Cheta River/1)	31,121	1. 9.54	31. 8.58
West Lusaka (Chilongola/3)	61,008	1. 9.54	31. 8.58
North Broken Hill (North Broken Hill/5)	110,161	1. 5.55	31.10.58
Lower Kaleya (Lower Kaleya/6)	70,124	1. 8.55	31. 7.58
East Lusaka (Chalimbana/7)	100,729	1. 7.56	30. 6.58
Mazabuka (Mazabuka/8)	116,987	1.10.56	30. 9.59
TOTAL	555,742		

In addition to the above, 10,053 acres were planned in 1952/53 in the Upper Kaleya Pilot Scheme, bringing the total acreage up to 30th June, 1957, to 565,795.

PLANS COMMENCED SUBSEQUENT TO 30.6.57 UNDER THE OLD FEDERAL CONDITIONS

Area and Plan Name and Number	*Acreage*	*Commencement Date*	*Completion Date*
North Kalomo (Mukwela/10)	40,491	22.1.58	20.1.61
South Broken Hill (Munga River N/11)	41,116	21.4.58	20.4.61
Zimba (Bowood East/9)	68,150	5.8.58	4.8.61
TOTAL	149,757		

PLANS COMMENCED SUBSEQUENT TO 30.6.57 UNDER NEW FEDERAL CONDITIONS UP TO 30.9.59

Area and Plan Name and Number	*Acreage*	*Date Approved*
West Lusaka (Molendemo N.W.12)	21,264	30.10.58
South Choma (Sibanyati/24)	30,000	15. 1.59
North Lusaka (Lower Chongwe/50)	72,000	30. 5.59
Monze/Pemba (Kazangula/33)	45,000	30. 6.59
Magoye/Lower Kaleya (West Kaleya/39)	26,258	20. 6.59
Livingstone (Matesi/15)	48,376	19. 6.59
Mwomboshi (Miswa/56)	5,000	21. 8.59
Livingstone (Maramba/14)	68,746	31. 7.59
South Broken Hill (Nyama West/58)	64,132	4. 9.59
Monze/Pemba (Demu/31)	46,770	1. 3.60
Nega-Nega (Lusito/40)	29,102	13.10.59
East Chisamba (Malo/54)	51,537	15.11.59
TOTAL	508,185	

PLANS COMMENCED SUBSEQUENT TO 30.9.59 UNDER NEW FEDERAL CONDITIONS

Area and Plan Name and Number	*Acreage*	*Date Approved*
North Choma (Upper Mbabala/27)	56,920	Not yet approved.
Chilanga (Lilayi/45)	71,900	
West Chisamba (East Wangwa/53)	78,381	
Zimba Bowood (Luezi/17)	102,834	9.5.60
North Kalomo (Kalomo/21)	82,501	2.5.60
Monze/Pemba (Demu/31)	46,770	1.3.60
Magoye (Magoye/37)	79,043	24.9.60
West Lusaka (Molendemo West/46)	50,856	1.8.60
East Lusaka (Mwanza/48)	53,808	22.7.60
East Chisamba (Upper Chongwe/53)	37,711	20.7.60
South Broken Hill (Nyama/57)	49,402	11.8.60
West Chisamba (West Wangwa/59)	73,802	3.12.60
TOTAL	783,928	

PLANS IN THE PROCESS OF BEING WORKED ON

North Lusaka (Ngwerere/49)
North Kalomo (Lower Mwemba/20)
North Kalomo (Upper Mwemba/22)
South Choma (Simkanka/23)
South Choma (Sikalanga South/25)
South Choma (Batoka/30)
North Choma (Sibanyati West/26)
Monze/Pemba (Mabusebo/35)
Monze/Pemba (Tambero/36)
Upper Kaleya (Mbaya/38)
Nega-Nega (Nega-Nega/41)
Nega-Nega (Lower Nega-Nega/42)
Chilanga (Dem/44)
West Lusaka (Chunga/47)
West Chisamba (Kalola/51)

It was always envisaged by the Department that a stage would be reached when there would be more plans prepared than there would be funds available to implement them.

The Regional Planning Sub-committee of the Natural Resources Board has taken over the duty of allocating priorities; these are based on the urgency of the works. So far they have been able to give a reasonable spread over the whole of the line of rail.

Regional Planning (Stage I) will soon be completed. Every Committee where the Conservation Officer concerned has completed the Stage I plans of the area for which he is responsible, should encourage Stage II or Farm Planning to be commenced. This is distinctly in the farmers' interests even in those cases in which financial assistance may not be available for some time. These plans are invaluable in that they make possible a proper organization of the farming effort and help the farmer, in each case, to reap the most economic returns.

(b) *Farm Planning*

Apart from a few farm plans done in Mazabuka and Lusaka and the farm planning on the Copperbelt, all the efforts of the staff have been devoted to regional planning.

However, a great deal of work has been done for the Agricultural Lands Board and the Farmers' Debt Adjustment Board in analysing individual farms for an assessment of their natural resources. Farm budgeting analysis has also been done but the assistance of an agricultural economist is rightly required for this task.

(c) *Miscellaneous Planning*

(i) *Mkushi.* Planning has steadily progressed and to-day some 102 farms have been planned, of which 44 have already been occupied or will be in the next few weeks. During the year the Department surveyed 52,406 acres and put forward proposals for the subdivision of the area into 38 farms based on the amount and distribution of arable soil. With the skill and enthusiasm of the farmers this area has more than proved the contention of the Department that Mkushi is one of the best tobacco areas in the Federation.

(ii) *Copperbelt.* Despite the fact that the staff position on the Copperbelt during the year was not very satisfactory, agricultural information was supplied to the Special Commissioner and maps were made of the proposed agricultural areas (using the Copperbelt Land-Use Survey) for inclusion in the First Report on a Regional Survey of the Copperbelt.

(iii) *Abercorn.* Periodic visits by officers to advise individual farmers were made to Abercorn and the Northern Province.

13. GOVERNMENT EXPERIMENTAL FARMS

Great progress was made initially on the Copperbelt's Experimental Farm until a survey by the Government indicated that a large dam could possibly be constructed very near the existing Experimental Farm, and if built, would flood all existing developments there. Because of this reason it was decided to delay any further development until this matter had been cleared up.

The Chalimbana Experimental Farm experienced unfavourable weather conditions and crops were poor. More experimental work is now being undertaken and the erosion plots have been laid out. Greater attention is being paid to the beef side of the farm and feeding trials will be undertaken.

Little further development is taking place at the Msekera Experimental Farm. Flue-cured Virginia tobacco trials will not be carried out there again because of the unsuitable soils that exist on the farm. Very good results were obtained from the maize and groundnut trials that were done during the season.

Good progress has been made at the Mochipapa Experimental Station and the numerous trials carried out during the year were most successful. The Africander type beef herd is doing well and the results of good management and feeding are now being reaped.

CONCLUSION

The progress of the Department during the period of Federation has been remarkable and thanks must be given to those who have made it possible.

I wish, therefore, to express my very sincere thanks to all the members of my staff for their loyal support and devotion to duty during a most difficult year.

Our work has been greatly facilitated by the generous co-operation and encouragement given by the Natural Resources Boards of Northern and Southern Rhodesia, the Agricultural Lands Board of the former territory, the Intensive Conservation Area Committees and the Group Organizations, the Rhodesia National Farmers' Union and the Tobacco Research Board of Rhodesia and Nyasaland. I am indeed most grateful to them all. I wish to acknowledge also with gratitude the co-operation and help that has been given us in unstinted measure by the Department of Research and Specialist Services and other departments, not only in this Ministry but also of the Federal and Territorial Governments of Northern and Southern Rhodesia and of Nyasaland.

To the many farmers themselves whom it has been my privilege to serve, I owe a debt of gratitude for everything that they have done to help me in my task. I greatly appreciate and value their friendship and goodwill.

REPORT OF THE DIRECTOR OF VETERINARY SERVICES FOR THE YEAR ENDING 30th SEPTEMBER, 1960

The Department of Veterinary Services operates with two branches—Field and Research—and the Annual Reports of the Assistant Directors in charge of these branches are given in full. It therefore is necessary only to comment on some of the more important aspects of the information separately compiled by these officers.

Staff. The professional and technical establishment was well under strength throughout the year. Only two new professional appointments were made. Advertisements in the United Kingdom and South Africa resulted in a few inquiries but no recruits. There is a world shortage of veterinary officers and competition for their services is keen. We are handicapped here by the fact that larger salaries are offered elsewhere, and also by the unsettled political outlook. Professional services were maintained at all centres with the exception of Enkeldoorn. The lack of trained laboratory assistants considerably retards the output of the Research Branch.

Again the shortage of Meat Inspectors automatically slows up the operations at the Cold Storage Commission abattoirs.

The shortfall in trained Animal Health Inspectors also presents a problem of its own. These men are recruited locally and after a certain amount of training are sent into the field. When time permits they are withdrawn for further training. Over the years the duties, training and responsibilities of the lay staff have increased considerably. The in-service training provided at local centres, for the more promising men, has proved of great value to the country in general.

It is gratifying to record that Mr. R. M. Roberts of the Research Branch was granted an F.A.O. Scholarship to proceed to Scandinavia and the United Kingdom for the purpose of studying techniques related to research into the problems connected with reproduction and artificial insemination. The knowledge acquired will prove invaluable to furthering our investigations into the breeding problems of cattle in this country.

Mr. J. R. Philip went to the United States of America under a partial International Educational Exchange Scholarship and Fulbright Travel Grant for the purpose of studying poultry pathology at the Kansas State College.

To a vastly expanding poultry industry such as ours a poultry pathologist is an urgent necessity.

Mr. W. P. Boyt, the Senior Veterinary Trypanosomiasis Officer, spent a profitable four months touring East and West Africa on an F.A.O. Scholarship, examining methods of tsetse control and the maintainance of cattle in tsetse infested areas. The experience gained will be usefully employed in this country.

It is hoped that further scholarships will be forthcoming in the future to increase our knowledge and usefulness to the farming industry.

GENERAL

Little rain fell until late December and in the southern and south-western areas no major falls were recorded in January and February, 1960. Government promptly established Drought Relief Committees to promote the early evacuation of cattle from drought affected areas. This resulted in a considerable movement of stock to Northern Rhodesia which should have, in time, a marked effect in promoting the cattle industry in that territory. Thousands of cattle were moved to better grazing and every endeavour was made to induce native stock owners to reduce their holdings through auction sales and to move to better grazing.

It is recorded that sales were productive but that there was a certain amount of resistance to movements on to better grazing.

Foot and Mouth Disease. Despite the continued infection in the Kruger National Park the disease was not recorded on our side of the border. However, infection was confirmed on the 27th June, amongst a small herd of cattle maintained at the headquarters of the Wankie Game Reserve; on Maitengwe Crown lands (100 miles south) on the 5th July, and at Kazangula (130 miles north-west of Wankie Game Reserve) on the 8th September. At all three centres the virus was typed as S.A.T.I. by the World Reference Library, Pirbright. These centres were many miles apart with a large cattle population between each. The Maitengwe outbreak was adjacent to similar infection in Bechuanaland Protectorate. The factor common to the outbreaks was the high game population with resultant cattle-game contact. It is obvious that this contact will be maintained in the Wankie District until the proposed game fence is completed.

The game fence between the Wankie Game Reserve and the native reserves has unfortunately not yet been completed. Two different contractors took on this job and each failed. The fence is now being erected by our staff and good progress has been recorded. A cattle fence is also to be erected from the Nata River along the Rhodesia/Bechuanaland border southward to prevent the constant straying of cattle between these territories.

The outbreaks at Kazangula and Wankie National Park were very quickly contained. African staff were promptly moved in to control the cattle after which inoculation with field virus was effected.

The Maitengwe outbreak however, was not so easily isolated and spreads occurred into the Nata Native Reserve. The area was suffering from drought with the result that lack of water, grazing and concurrent population problems militated against effective cattle breaks being established.

It is interesting to record that cattle at eight dipping tanks which had been inoculated with S.A.T.I. field virus in 1957, gave low reaction. In the main the reactions to inoculations were in the under four years old group. It is evident that the immunity conferred following the 1957 inoculation was of a longer lasting character than previously recorded.

Since the 1957 outbreak all the cattle on our western border have been under intensive supervision without infection being detected. Ever since the Bechuanaland outbreak was confirmed intensive supervision of all cattle on our border from the Zambezi to the Limpopo has been maintained.

An appeal by the Bechuanaland authorities for assistance to control the outbreak in that country, necessitated the loan of one professional officer and twelve members of the lay staff.

At this stage it can be recorded that considerable progress has been made in the efforts to find a safe vaccine. The opportunity was taken to assess the results of a large field experiment undertaken by the Union Veterinary authorities using an S.A.T. II vaccine produced by the Pirbright Institute. Dr. I. A. Galloway, of Pirbright, visited us for the purpose of discussing vaccination, and the opportunity was taken by him to visit the Maitengwe outbreak and examine our methods of control, with which he expressed himself satisfied.

Rabies. It is very pleasing to record a reduction in the number of cases. In all fifteen cases were confirmed (human 1, dogs 14) as compared with 28 the previous year. Two vaccinated dogs developed rabies, one within 10 days of vaccination and the other after five months. No account need be taken of the first one but it is disconcerting to report the breakdown in the dog which had been vaccinated five months previously. Once again, with one exception, all cases were recorded from our borders.

With control so well established within the country it is regretted that eradication of the disease cannot be attained so long as we cannot prevent reinfection from adjoining territories.

Trypanosomiasis. This disease is regarded as one of our most important problems. Cattle have been successfully maintained in areas lightly infested with tsetse fly through the medium of the present, not inconsiderable, armoury of trypanocidal drugs. The field report indicates that a total of 76,496 head were treated either on a prophylactic or curative basis. In fact a total of 115,773 inoculations was given, which is an increase of 25,000 over the previous year.

Out of a total of 51,005 smears examined 1,398 were positive. This is also an increase.

Owing to the development of resistant strains of trypanosomes to prophylactic drugs, and staff shortage, the experimental station at Kariangwe was closed down. In view of the fact that the efficacy of trypanocidal drugs varies from country to country and even in different localities, it is essential to maintain such an experimental station to gauge the efficacy of trypanocidal drugs and in this connection it is hoped to reopen another small station in the near future.

With the exception of the south-eastern area, the overall position has remained to a large extent unchanged, with definite signs of improvement in some localities.

The south-eastern portion of the country has been the cause of a certain amount of worry. The Department of Tsetse and Trypanosomiasis, on this front, started a combined bush clearing and insecticidal attack which is already beginning to show results.

Here it can be stated that Government has approved of a policy for the integration of the Department of Tsetse and Trypanosomiasis within the framework of Veterinary Services. Over recent years both departments have collaborated very closely, but it became obvious that there would be additional advantages in uniting both departments in order that the attack on both the tsetse and the disease would be consolidated. It is anticipated that this policy will be implemented in the near future.

Tuberculosis. By the end of the year a total of 38,295 head of dairy cattle were under regular tuberculin test as compared with 37,981 the previous year. This represents approximately 60 per cent. of the milch cattle in the country. Reactors continue to decline in numbers, these being only 41 as compared with 92 last year. Nine beef herds comprising 4,879 head were tested and only eight reactors revealed.

The annual test on a large ranch in Matabeleland was again undertaken and only 221 reactors uncovered, representing 0.53 per cent. infection as compared with 1.13 per cent. the previous year. Unless three tests a year can be carried out on this ranch it is doubtful if the percentage of reactors will be quickly reduced.

During the year 67,491 tuberculin tests were performed giving a reaction percentage of 0.49 which is considered to be very good indeed.

It is apparent that there is still a hard core of dairymen whose herds remain untested. The reason for this state of affairs is the fear that their financial losses will be too great should anything but a low incidence of infection be revealed. In order to overcome this fear a new compensation scheme was devised whereby compensation of 30 per cent. will be paid for any reactor with a maximum of £50 per cow and £100 per bull.

So far few of the untested herds have signed on although the scheme was given publicity.

A sudden increase of participants might be difficult to deal with as professional officers, on account of pressure of other duties, are fully extended to maintain the present position of regular testing.

Infertility Diseases. A number of conditions cause infertility in cattle either of a temporary or permanent nature. However, the main diseases are contagious epididymitis and vaginitis (epi-vag), contagious abortion and vibriosis.

Contagious abortion today presents no problems as it can readily, economically and efficiently be controlled by vaccination. Propaganda drives continued throughout the year with varying success to induce stockowners to make the fullest use of this valuable vaccine.

Epi-vag on the other hand, is not so easily resolved. It is pleasing to record that only one new centre of infection was confirmed during the year. Only twenty-one properties are at present under quarantine restrictions. The incidence of infection is, in the main, confined to large ranching properties where owners contend that fertility is not greatly affected. Total eradication from these ranches will, it is foreseen, take a long time in view of the lack of co-operation on the part of the owners.

Vibriosis has been confirmed on a number of properties and this has caused a certain amount of alarm particularly amongst the dairy farmers who have demanded that the disease be put on the scheduled list. This has been resisted on the ground that it is easy enough to quarantine a property when infection is found but not so easy to state when infection no longer exists. Further, infertility is, as a rule, of a temporary nature and although it can cause serious economic loss, particularly in dairy herds, the use of antibiotics and artificial insemination can quickly bring the infection under control.

The low calving rate has been the subject of many discussions and a case was made out for the Agriculture Research Council to undertake a survey on this problem. Arrangements are now in hand for a survey to be made early in the coming year.

Ticks and Tick-borne Diseases. In general it can be stated that there has been a distinct improvement in tick control. It must be appreciated that drought conditions were not conclusive to a build up of the tick population. Nevertheless it is clear that in those areas, where dipping has been suspended owing to the low condition of stock, there will be a considerable upward surge in the tick population early in the coming year. The present day armoury of organic acaricides has set up a number of problems as a result of their misuse. Prewar, stock-owners depended entirely on arsenical preparations for tick control but nowadays the position has changed as a result of the advent of the organic acaricides. The main trouble lies in the irregularity of dipping and the abuse of these modern preparations. Strong propaganda measures were adopted all over the country in an endeavour to educate the farming community in the proper use of the organic acaricides. As a result it is now becoming clear that more logical thought is being shown with regard to the employment of the organic acaricides. Following on cattle mortalities through the misuse of the organics and resultant tick-borne diseases, stock-owners are returning to an arsenical basis with the employment of organic preparations at peak periods on a selective pattern depending upon the species of ticks concerned. Mortality from tick-borne diseases showed a decline. For instance, the disease theileriosis *(Gonderia lawrencei)* was recorded from 37 farms as compared with 33 the previous year, yet the actual mortality was very much lower than previously recorded.

Tick flushes and tick-borne diseases normally coincide with major crop activities with the result that tick control measures may be neglected in favour of other more pressing work. It is considered that the armoury of efficient acaricides now on the market should reduce to a minimum the losses from tick-borne diseases.

Parasitology. One of the most important problems of successful cattle and sheep rearing is that of internal parasites. The development of irrigated pastures for both milk, and to a limited extent, mutton production, has sparked off a problem in the control of internal parasites. It is presumed that this problem will assume greater importance as such pastures provide ideal conditions for the perpetuation of parasites. One Research Officer has been engaged exclusively on parasitological investigations.

All Field Officers, when pressure of work permits, have undertaken a considerable amount of propaganda for the purpose of stimulating stock-owners to exercise control of internal parasites.

Zoonoses. The diseases listed under this heading, of which there are over a hundred, should receive very much more attention on a combined Medical and Veterinary basis than hitherto. It is true that the Department has in hand, measures for the control of bovine tuberculosis, brucellosis and rabies. Again the Department is responsible for the inspection of meat at the Cold Storage Commission abattoirs only, meat inspection elsewhere in the Colony falls under the Ministry of Health or Municipal Authorities.

The time has now arrived to bring the Medical and Veterinary Authorities together to ensure close collaboration and the formulation of policies in a combined attack against those diseases which are naturally transmitted between animals and man.

Artificial Insemination. Following upon representations by this Department, the Ministry of Agriculture set up an Artificial Insemination Advisory Committee whose functions were to be advisory only. In all, three meetings were held during the year.

The number of doses of semen used during the year increased from a total of 6,086 the previous year to 8,036. This increase is gratifying but it is still not enough.

Artificial insemination, apart from its value in disease control, is today recognized throughout the world as being of the greatest importance in herd improvement. At the 1960 Rhodesian National Farmers Union Congress, considerable stress was laid on herd improvement in dairy cattle and therefore it is not understood why greater use has not been made of the service offered. Trial consignments of Friesland and Jersey deep frozen semen were imported from the Union of South Africa. The semen was initially obtained as a pilot scheme to confirm that the conception results would be satisfactory, as indeed they were. There have been considerable arguments for the regular importation of semen from high quality bulls and equally strong arguments against such a practice.

All three artificial insemination centres, Bulawayo, Gwelo and Salisbury operate on deep frozen semen.

Research: Poisonous Plants. As little work had been done on poisonous plants of Southern Rhodesia, this subject was taken up and pursued with vigour.

Bowel Oedema in Pigs. It is considered that this condition is responsible for the greatest number of deaths of weaners in the country and has therefore called for investigation. These investigations have been carried out in close collaboration with the Central Veterinary Laboratory at Weybridge.

Low Fertility in Ranch Cattle. Field experimentation continued but it must be recorded that work of this nature can only be a pointer which later must be closely linked with detailed laboratory investigations. For years attention has been largely centred on the effects of various diseases on fertility, particularly brucellosis, vibriosis and epi-vag, but it has become obvious that in a great majority of cases of herd infertility no effective agent can be demonstrated. It is therefore hoped that the field experiments which have been in progress for some years will provide sufficient information to be followed by detailed laboratory work.

Beef Production. Early in the year the Ministry of Agriculture introduced a policy of increasing beef production. The task of implementing the policy fell upon the Department of Conservation and ourselves. Following upon a meeting between the senior officers of these two departments plans were made for propaganda measures such as field days, farmers association meetings and discussion groups. Everyone concerned co-operated well and it is obvious even at this early stage in the campaign, that success will be assured.

CONFERENCES

The Director attended two meetings at Pretoria. The first in connection with the foot and mouth disease vaccination experiments, the second was for the purpose of discussing the disease position in Bechuanaland. Visits were also made to Northern Rhodesia and Bechuanaland.

ACKNOWLEDGEMENTS

The high standard of efficiency with which the staff carried out their duties often under extremely trying conditions, is acknowledged with deep appreciation. Thanks are also extended to other departments both Federal and Territorial, whose valued co-operation and help were freely given. The co-operation and help given by the Rhodesia National Farmers' Union also has been much appreciated.

J. MacKINNON,
Director of Veterinary Services.

ANNUAL REPORT OF THE ASSISTANT DIRECTOR OF VETERINARY SERVICES (FIELD) FOR THE YEAR ENDING 30TH SEPTEMBER, 1960

STAFF

Assistant Director of Veterinary Services (Field): Mr. T. Lees May.

Senior District Veterinary Officers: Messrs. J. M. Williamson, H. M. Hodkin.

District Veterinary Officers: Messrs. J. Ross, A. E. Gillespie, R. W. Bryson, A. D. Hurrell, J. E. Robinson, A Wilson.

Senior Veterinary Trypanosomiasis Officer: Mr. W. P. Boyt.

Senior Government Veterinary Officers: Messrs. J. L. M. McCulloch, J. D. Adamson, V. A. D. Browne, R. S. Dugdale, A. J. E. Needham, I. A. Walker.

Government Veterinary Officers: Messrs. J. A. Lawrence, G. H. Stewart, R. L. McKenzie, A. C. Harkness, C. S. M. Kilroy, J. W. Thomson, J. T. R. Robinson, P. K. I. Mackenzie, S. M. Hirst, K. B. White.

The Field Establishment of 30 professional officers had four vacancies at the end of the year.

Three resignations were tendered, one unfortunately being that of a senior officer. A further resignation is in hand.

New Appointments. Mr. S. M. Hirst, 31st December, 1959; Mr. K. B. White, 19th September, 1960.

The recruitment of new staff is proving a major problem. Even with slight improvements in salary scales, few veterinary surgeons are attracted to service in Africa in general, due to the unsettled political atmosphere.

Professional services were maintained at Bulawayo, Salisbury, Gwelo, Fort Victoria, Chipinga, Gwanda, Sinoia, Umtali, Plumtree, Que Que, Bindura and Wankie. It was found impossible to maintain the professional service at Enkeldoorn due to lack of staff.

The number and services of private practitioners reached a new total of 33 within the country.

No marked move into country practice has, as yet, occurred but major projects such as pregnancy diagnosis, spraying of heifers, herd infertility, etc., are gradually becoming the responsibilities of the practitioners in the more highly developed beef and dairy herds. Hunt clubs, pony clubs, racing and trotting developments have lead to an increase in services for equines. Major employment is, however, still in small animal practice in regard to practitioners.

Animal Health Inspectors. The year opened with five and terminated with three vacancies.

New Appointments	6
Superannuation	Nil
Resignations	3
Transfers	Nil
Discharges	3

With the ever increasing demand for veterinary services and advice, it has been realized that the Department is being forced to make more use of lay staff especially in the broad advisory capacity. More attention is being paid at local centres to training of lay staff in the main principles of disease prophylaxis and control with promising results. With the lessening of commercial competition for staff, it has been found possible to recruit a more educated type than hitherto possible and in-service training will be even more profitable in the future.

Establishment. Eight Senior Animal Health Inspectors, 70 Animal Health Inspectors.

Meat Inspection. These duties were performed at the Cold Storage Commission abattoirs at Bulawayo, Salisbury, Fort Victoria and Umtali.

Messrs. Liebig's Factory, West Nicholson, produced all goods from frozen dressed meat supplied from the Cold Storage Commission Abattoirs, Bulawayo.

No slaughtering was performed in 1959/60.

The staff establishment of fifteen Meat Inspectors has been found impossible to maintain. The year commenced with one vacancy.

During the year one resignation, one transfer and one new appointment occurred. A resignation is also in hand, and the Department therefore still has two vacancies. Repeated advertising has failed to secure new staff. The expanding meat industry with increased kills is being slowed down by the limited killing capacities of the present abattoirs and it is obvious that major reorganization in this respect is overdue.

Due to the advanced rate of slaughter, the margin of space between carcases is diminished adding difficulty to the task of the Meat Inspectors from the resultant crushed conditions.

It is hoped this will soon be remedied with the opening of the new pig factory which will absorb most of the pigs and relieve pressure in the main abattoirs.

Clerical Staff. Approved establishment, fifteen, consists of three established officers, three on probation and nine temporary employees. The employment of four African clerks was authorized but only two of these posts could be filled by suitable personnel immediately.

It is hoped that an increase in permanent staff will soon be possible.

Accommodation. Professional quarters were completed at Wankie, bringing the total of our staff accommodation to 34 houses.

Transport. All professional staff, with the exception of the most recent appointee, operate their private vehicles on official duties and the system has worked well with no lost days due to lack of transport.

The lay staff are finding it uneconomical to operate private transport in the relatively undeveloped areas of the country on the present allowances and some have reverted to Government transport. Several new recruits have also elected to use Government transport. Eighty-three per cent. of this staff are now using their private vehicles and this percentage will probably drop further unless revised allowances are made to meet rapidly increasing costs in purchase and maintenance of vehicles. The total man-days lost when operating Government vehicles is definitely greater than when operating private vehicles and it is to be hoped that better incentives will be offered to enable the latter system to persist.

GENERAL

Climate, Food and Water Supplies, and Condition of Livestock. The near drought conditions prevailing at the end of the last agricultural year persisted throughout the country till late December, 1959, and severe drought took toll of emaciated cattle in the Midlands and Matabeleland.

An estimated number of 27,000 deaths in European cattle in the Midlands was tabled, largely due to the exhaustion of supplementary ranch feed (silage, hay, etc.) after prolonged winter feeding. Losses were marked in the pregnant cow class and in new-born calves. Many surviving cows failed to breed this season and the loss in calf crop will be apparent for several years.

In Matabeleland an average figure of 4 per cent. loss was sustained in most native areas from poverty. In the drought-stricken areas, the immediate prospects for the remaining stock are markedly grim unless good, early rains fall.

The most southerly ranches on the Limpopo experienced their third season of drought and the majority are now virtually destocked.

Freak spasmodic rain storms were a feature of the early part of the season and general rains did not fall till late December, 1959. No major rains fell in January, 1960, and by February, drought relief committees on a Governmental basis were established to promote cattle evacuation from South Matabeleland mainly. Special sales in the native areas resulted in the evacuation of 94,000 head. 10,000 head were evacuated to Northern Rhodesia and on the whole have helped to promote their emergent cattle industry. Movements to other local grazing areas were resisted by some of the native populace however, and the deaths at the end of the year were rapidly mounting in number, figures of four to ten per day being recorded in various dipping areas by the end of September, 1960. Competition for the available water and grazing from game was intense in some of these districts and ranchers are now considering an orderly reaping of game for a meat crop as the only solution to this problem.

Failure of crops also added to the crisis in the resultant small yields from stock feeds grown in the European cattle areas.

A promising attempt to make silage from natural bush leaves and small twigs is in progress in South Matabeleland and can easily be of major future importance in the provision of fodder reserves with a fair protein content.

In the other two-thirds of the country however, the position in regard to stock was much more satisfactory. The same early patterns of poor rains prevailed and many crops were not good enough to carry through to reaping. These were converted into silage for cattle feeding.

With the lack of January rains, rank growth of herbage did not occur and grazing cattle were able to prevent the customary bolting. Late rains carrying on into May, 1960, kept ranch veld in a comparatively green state with persisting growth. North and north-eastern sectors have reported one of the best cattle years for many a season with absolute minimal losses. These areas absorbed many of the evacuated drought relief cattle with resultant gain in beef production in years to come. The absence of profuse rank grass has also minimized extensive veld fires with effective conservation of grazing.

The main adverse effect of the lack of rain in the areas not drought stricken, has been in the quick drying up of rivers, dams not being filled and general lack of surface water. Underground water level also fell markedly giving failure of water from many boreholes. The resultant drive for better water conservation has been very obvious. The standard of stock management has materially improved in provision of winter feed and a keener interest in disease prophylaxis.

Urea feeding increased in scope but its end results were directly proportional to the care exercised in its use. Careless handling resulted in too many deaths. The provision of solid compressed lick blocks with a salt/urea/molasses basis plus mineral supplements was of great benefit to many ranchers but failure to provide salt alone firstly before introducing such high urea content (40 per cent.) blocks lead to completely unwarranted losses of valuable stock which were suffering from salt starvation and over-indulged in the compound lick.

Cake and cube feeding (cotton-seed, groundnuts, meat and blood-meal cubes, etc.) increased in ranch herds.

Irrigation projects, especially in the Victoria District, opened up possibilities of new sources of winter stock-feed but the lack of a cheap disease-free high yielding legume is apparent, as yet, in these schemes.

The Dairy Industry remained at an indecisive cross roads of progress due to overproduction of milk and high feeding costs. The greater the expansion to cover overhead costs, the lower was the price per gallon produced. Many of the less efficient herds sold up, but others took their place. The uncertainty was reflected in the marked drop in prices paid at dairy dispersal sales, except in a few outside districts.

Sheep. The Sheep Breeders' Association made little visible progress. The number of flocks and standard of management improved but many flocks were side lines with little attention paid to regular dosing. Entero-toxaemia took toll of too many despite the ready availability of a preventive vaccine. Sheep on irrigated lucerne in the Sabi Valley reached high standards of production with complete absence of internal parasites. A resurrection of the sheep industry in the Eastern Highlands is in progress but an extremely wide and strict programme of vermicides is required to maintain control of internal parasites. Native production of sheep and goats in the more arid areas where main nutrition is browse and not grazing gave good finished carcases at a highly remunerative level, even in the drought stricken areas.

Pigs. The profit margin was reputedly small for the casual producers but established breeders maintained a steady production. Bowel oedema and enteritis in weaners caused considerable losses. Production in Eastern Districts is rapidly mounting, but as this is mainly based on feeding with brewing grain wastes from adjoining Native Reserves, it is evidently self-limiting.

Poultry. This industry has been characterized by wide fluctuations in the price of eggs and rising costs. Broiler production is increasing to meet a keen demand—importation of this type of stud stock has been made from the United Kingdom and America. Export of day-old chicks to neighbouring countries has persisted at a steady rate.

Tick Life and Dipping. Drought conditions were not conducive to tick multiplication in general. Several areas where dipping has been a physical impossibility due to lack of water and poor condition of cattle will, however, show resultant build up in infested veld later in the year.

Alleged resistance of the common blue tick *(Boophilus* sp.) to arsenical dips in the lowveld proved to be linked with long interval dipping and resultant oxidation of the arsenite to arsenate.

Organic phosphate preparations undoubtedly proved highly specific in regard to the blue *(Boophilus),* but brown and red-legged ticks *(Rhipicephalus* sp.) were not controlled. The production of a Toxaphene dip miscible with an organic phosphate materially helped in that vat contents could be kept at top strength in respect of each component to give full tick cover throughout the seasons. The continued widespread use of Toxaphene, especially in the lowveld, with a high level of kill of bont *(Amblyomma* sp.) and bont-legged *(Hyalomma* sp.) ticks practically abolished the incidence of screw worm infestations.

More logical thought is being shown by stock-owners in regard to employment of the organic acaricides. A welcome return to an arsenical basis in dipping tanks with the employment of organics at peak periods on a selective basis, in regard to the tick species concerned, was noted. Nevertheless, it still has to be recorded that where arsenicals were properly employed and supervised with full regular production fo cattle, a complete control of ticks was achieved, both in European and Native areas.

Despite propaganda to the contrary, deaths from the misuse or mishandling of concentrated organic acaricides rapidly approached those from arsenical preparations in numbers.

The tendancy to embark on the use of costly organic preparations to regain control wwhere dipping has been neglected and then to completely prejudice the resultant gain in control by dipping thereafter in understrength solutions at spasmodic intervals on the grounds of economy and the supposed sustained efficacy of the new dip was widespread. This eventually lead to a greater re-infestation. Such practices only create resistance in ticks and denigration of worthwhile weapons in tick control. With the lack of vat-side rapid tests of organics, these practices were difficult to detect by inspectors and were only recognized once gross infestation recurred, when it was too late and the harm had been done.

Quarantine Notices (tick infestation and not tick-free)

Veterinary Districts: Bulawayo, 218; Salisbury, 260; Fort Victoria, 58; Gwelo, 236; Umtali, 51; Chipinga, 64; Sinoia, 49; Gwanda, 91; total, 1,027.

Contraventions

(a) Cattle Cleansing Act: Bulawayo, 301; Salisbury, 81; Fort Victoria, 159; Gwelo, 108; Umtali, 19; Chipinga, 33; Sinoia, 6; Gwanda, 334; total, 1,041.

(b) Animals Diseases Act: Bulawayo, 190; Salisbury, 49; Fort Victoria, 62; Gwelo, 169; Umtali, 133; Chipinga, 23; Sinoia, 4; Gwanda, 55; total, 685.

Livestock Inspections. The total number of cattle inspected by members of staff during the year under the Cattle Cleansing Act and the Animals Diseases Act was 17,607,590.

SCHEDULED DISEASES

Viral and Rickettsial Diseases

Foot and Mouth Disease. The welcome absence of this disease from the old Victoria enzootic area was again noticeable, despite the presence of infection in the adjoining Kruger Park Game Reserve, but reports in early June, 1960, of a build up of infection on our Western borders in Bechuanaland Protectorate were soon followed by spreads into our country.

Wanki Native District. On the 27th June, 1960, the disease was confirmed in 80 head of cattle at Headquarters in the Wankie National Park. This was typed as S.A.T.I., approximately 50 per cent. being affected. Mouth lesions were noted in three contact sheep. One grysbok fawn being reared on milk from the affected herd showed vesicular mouth lesions and died from the typical hyperthermia with pleural and pericardial ecchymoses heretofore seen in naturally infected calves.

In the surrounding wild game, sharing a common water-hole with the domestic stock, infection was only seen in kudu. One bull showed heavy foot vesiculation and was killed by carnivora. Three kudu calves had evidently succumbed to the disease judging by the hoof lesions but were too decomposed for post-mortem examination when found. Test killings of in-contact buffalo revealed no signs of infection.

The affected herd was immediately virused with a 100 per cent. reaction in the unaffected 50 per cent. Close herding was effected and the infection was contained.

On the 8th September, 1960, infection was diagnosed at Kazangula Irrigation Project, about 130 miles as the crow flies, in a north-westerly direction from the first infection. As large numbers of susceptible cattle lay between these two centres and these had been under constant inspection in the intervening period, with negative findings, it seems highly unlikely that these two infections could be related except to an extraneous common source, probably game movement from the Park along the north-west border. This infection was also typed as S.A.T.I. All cattle were virused on the 15th September, 1960, 742 head, giving a 98 per cent. reaction. Two calves died as a result of virusing.

This herd was concentrated within the project under close cattle guard control, good cattle breaks being secured to the east and south.

However, this area contains many evacuated European Drought Relief cattle and straying has been a constant problem and hazard. This will persist until rains eventuate and settle cattle on their respective grazings.

Bulalima-Mangwe Native District. On the 5th July, 1960, infection was discovered at Makanda in the Maitengwe Crown lands, contiguous to known infection in the adjoining Protectorate. This was typed as S.A.T.I. Control was compromised by lack of water and grazing with concurrent native population problems and the disease had spread to Hingwe in the adjoining Mpimbila Native Purchase Area by illegal movements and contact, this being confirmed on the 7th July, 1960. An immediate attempt to create a cattle-free belt between these areas and the Nata South Reserve was greatly prejudiced by refusal of natives to move cattle. A total of 3,054 Hingwe cattle and 547 Makanda cattle were virused on the 22nd and 23rd July, 1960, giving 80 per cent. reactions.

Owing to the lack of an effective intervening stock-free area, infection spread deeper South into the Mpimbila Native Purchase Area and into the Nata South Reserve at Masendu and Tema Tema respectively on the 2nd and 12th August, 1960. Owing to drought and population pressure negating any mass movement of cattle it was decided that the whole of the Nata South Reserve must be included within a cordon. This necessitated provision of new water pumps, cutting of cordon roads in order to include river watering points, grazing, etc., a lengthy process.

Virusing of the whole Reserve was effected as follows:

Date	*Dip*	*Cattle*	*7 day % reaction*	*14 day % reaction*	*Re-virusing, % reaction*
19.8.60	Tema Tema	3,058	90		
25.8.60	Mpimbila	2,573	100		
26.8.60	Ngome	3,757	90		
1.9.60	Masendu	2,558	90		
2.9.60	Ndolwane	1,544	50	50	Nil
3.9.60	Mambo	2,800	90		
7.9.60	Ngwale	2,641	50	50	Nil
7.9.60	Susape	1,116	50	50	Nil
9.8.60	Dupute	1,147	25	25	Nil
8.9.60	Sihore	780	25	25	Nil
9.9.60	Tegwane River Posts .	1,535	50	50	Nil
10.9.60	Nanda	1,780	25	25	Nil
10.9.60	Ntole	2,598	25	25	Nil
14.9.60	Gambo	1,768	95		
14.9.60	Bulengoma	1,206	90		
15.9.60	Mosa	1,804	90		
15.9.60	Malikonga	2,006	90		
16.9.60	Tegwane	1,585	90		
16.9.60	Langabe	1,947	90		
17.9.60	Bidi	1,878	85		
17.9.60	Mahamba	1,575	95		
20.9.60	Somfula	1,932	95		
20.9.60	Mtunungwe	731	95		
	TOTAL	44,319			

Check typing of all spreads and reactors to virusing confirmed the presence of S.A.T.I. only throughout the whole of this outbreak.

Of the 22 dips virused, eight showed very low reactions of 25 to 50 per cent., major response being seen in animals under four years of age. The reaction in this latter age group was recorded as 60 per cent. but may have been higher, as 4 to 8 per cent. developed a delayed almost inapparent reaction. The reaction in animals in the three to four year group was plus or minus 5 per cent.

These eight tanks were virused in the 1957 outbreak, also with S.A.T.I. and this exhibited residual immunity is of a longer lasting character than usually recognized previously. It should be stressed that in the interim (1957-1960) all these cattle were under short-term regular full inspection with no disease being found.

Nyamandhlovu Native District. Despite provision of supplementary watering facilities and a strong police cordon, the cattle pressure on the river front between Nata South and Nata North Reserves lead to endless straying. Even though cattle were seized and owners prosecuted, plus shooting of strays, infection spread to the North Nata Reserve on the 21st September, 1960, being confirmed at Mahleke Dip.

The year closed with the shifting of the cordon to try and confine the disease to North Nata Reserve and arrangements for its virusing in hand.

The whole handling of this disease has been unfortunately put to hazard by drought, lack of water and grazing, overstocking and failure of crops amongst the natives engendering a rather unco-operative attitude.

In view of the threatening position in regard to this disease in the adjoining Bechuanaland Protectorate, one Veterinary Surgeon and twelve Animal Health Inspectors were loaned in order to help control.

A close co-operation with the veterinary staff of this Protectorate has been maintained throughout these outbreaks to our mutual benefit.

Rabies. The following cases were confirmed during the year:

Native District	*Number Cases*	*Date of Last Case*	*Species*	*State of Vaccination*
Beitbridge	1	31.10.59	Dog	Not Vaccinated
Bulalima-Mangwe	2	2.7.60	2 Dogs	Not Vaccinated
Charter	1	16.11.59	Dog	Not Vaccinated
Chipinga	1	28. 7.60	Human	
Gwanda	1	8. 9.60	Dog	Not Vaccinated
Nyamandhlovu	5	24. 3.60	4 Dogs	Not Vaccinated
			1 Dog	Vaccinated
Umtali	4	23. 8.60	3 Dogs	Not Vaccinated
			1 Dog	Vaccinated

Results according to species: One hundred and twelve specimens were examined by the laboratory during the year.

Positive cases were —	Dogs	14
	Human	1
	TOTAL	15

This brings the total number of positive cases since the first outbreak to 908.

That the Colony-wide vaccinal cover is giving protection can be deduced from the following statistics:

Year	1954	1955	1956	1957	1958	1959	1960
Specimens submitted	474	264	181	208	165	117	112
Specimens positive	183	100	54	50	41	28	15

No cases were recorded in feral animals for the first year since the original outbreak in 1950.

With control so well established, it is regrettable that the next logical step of eradication cannot be embarked upon as long as fresh invasions of this disease from neighbouring countries occur.

All positives were recorded in the districts adjoining territories where control by sustained mass vaccination is not in vogue. All cases in dogs were in unvaccinated strays except two young dogs at centres with positive cases previous to vaccination of the subject.

One vaccinate developed rabies within 10 days of being vaccinated, the other was vaccinated five months previously.

The human case originated on the Portuguese East African Border. A child was bitten by a stray dog, which was not reported until rabies symptoms developed in the child. Complete check of the locality was negative.

Compulsory double vaccination of all dogs at three to four months and one year of age continues but publicity drives plus house to house checks still have to be maintained to secure the requisite cover.

In native reserves, compulsory checks of dogs at time of cattle inspection have been necessitated, a total of 82,895 dogs being inspected regarding status of vaccination.

During the year, 309 unvaccinated dogs were destroyed and 320 persons of all races prosecuted, mainly for failing to have dogs vaccinated.

A total of 141,959 dogs was vaccinated during the year, bringing the total of inoculations with Lederle's Flury Strain vaccine to 1,139,623 since July, 1951.

Contagious Epididymitis and Vaginitis. Incidence is now largely confined to large ranching properties where control is mainly on a mass basis and little attention can be spared for individuals. Fertility is not greatly affected but the odd cases are seen in bulls and the disease is of little economic significance to the rancher. Any drive for eradication, therefore, secures minimal co-operation and this hard core of infection will prove difficult in final elimination.

Only one newly infected centre was disclosed but twelve were released from quarantine regulations, reducing the total to twenty-one properties under restriction.

Lumpy Skin Disease. Mild sporadic incidence of little economic significance was noted throughout most of the country. An extensive spread was recorded in the Wankie Native District between February and April, 1960, but this faded out to a few mild sporadic cases.

The incidence in the Bechuanaland Protectorate cattle undergoing quarantine prior to importation to this country, as recorded in the last Annual Report, continued unabated from October, 1959. Final clearance from this disease was only seen in March, 1960, when importation was resumed.

Heartwater. The ever increasing use of Toxaphene dips in the lowveld with better control of bont ticks plus the ready availability of specific anti-biotics giving good results in early treatment has decreased the incidence of this condition.

Only 83 cases were reported, not all being confirmed, but this probably only represents a minor percentage of the total occurrence.

It is still noted that introduction of susceptible adult stock on to heartwater veld gives a high percentage of mortalities of a hyper-acute nature with little response to specific anti-biotics even if treated in an early stage.

BACTERIAL DISEASES

Anthrax. This was confirmed on a ranch in the Wankie Native District, four deaths having occurred in cattle.

382 vaccinations were performed on the infected place; three adjoining properties were vaccinated on a prophylactic basis involving 1,823 head, and no further spreads occurred.

One human case of anthrax was recorded from Lupane Special Native Area A, a native woman who had consumed meat from a dead animal. Checks in the area, which was already being maintained on an annual anthrax vaccination basis, failed to disclose any other cases, human or animal.

In view of the incidence of anthrax in antelope in the Kruger Park near to our Southern Border, prophylactic vaccination was effected in the adjoining Sengwe and Beitbridge Special Native Area. A total of 13,200 head was inoculated.

VACCINATIONS

(*a*) GAZETTED ANTHRAX AREA — ANNUAL VACCINATIONS

District	*Cattle*	*Donkeys*	*Sheep and Goats*	*Total*
Victoria	3,380	152	243	3,775
Gwelo	34,101	280	3,116	37,497
Nkai	62,223	—	—	62,223
Lupane	52,165	—	—	52,165
Que Que	4,741	80	707	5,528
Wankie	2,205	—	—	2,205

(*b*) PROPHYLACTIC INOCULATIONS

District	*Cattle*	*Donkeys*	*Sheep and Goats*	*Total*
Victoria	6,000	—	—	6,000
Beitbridge	7,200	—	—	7,200
GRAND TOTALS .	172,015	512	4,066	176,593

Tuberculosis

(a) Imports tested, 1,162; reactors, 1.

(b) Exports tested, 4,991; reactors, 13.

(c) Old Voluntary Scheme:

Veterinary District	*Number of Herds under test*	*Number of Cattle under test*	*Number of Reactors found during year 1959/60*
Salisbury	100	6,806	7
Bulawayo	40	3,881	—
Umtali	17	1,088	1
Gwelo	14	1,299	—
Chipinga	5	370	—
Sinoia	6	988	—
TOTALS	188	14,432	8

(d) Compensation Scheme:

Veterinary District	*Number of Herds under test*	*Number of Cattle under test*	*Number of Reactors found during year 1959/60*
Salisbury	121	10,861	28
Bulawayo	44	4,050	4
Umtali	43	4,288	1
Gwelo	13	1,248	—
Victoria	14	973	—
Chipinga	21	1,304	—
Sinoia	7	508	—
Gwanda	5	631	—
TOTALS	268	23,863	33

(e) Voluntary Scheme (beef herds):

Veterinary District	*Number of Herds under test*	*Number of Cattle under test*	*Number of Reactors found during year 1959/60*
Salisbury	6	4,664	—
Bulawayo	1	151	6
Sinoia	2	64	2
TOTALS	9	4,879	8

SUMMARY: AGREEMENT TESTING

Dairy Herds:

Total number of herds under test	456
Total number of cattle under test	38,295
Total number of reactors, 1959/60	41

Beef Herds:

Total number of herds under test	9
Total number of cattle under test	4,879
Total number of reactors, 1959/60	8

A more generous scale of compensation has been granted by the Government and it is hoped that this will bring the waverers into the scheme.

Thirty-five new herds were enrolled under the Compensation Scheme.

Twenty-four herds ceased testing, mostly being dispersed on sale and added to herds already under test.

It is hoped to bring all herds gradually under the Compensation Scheme but as it exacts a few more legal liabilities in regard to the owner's responsibilities than the Old Voluntary Scheme, owners are reluctant to change. The new agreement is also aimed at getting all herds to an attested status in order to reduce the frequency of testing which would lighten the present heavy demands on staff in this respect.

The total number of dairy herds now under test represent about 60 per cent. of milch cattle.

There has been a gain of 11 herds in the overall workings of the year

Reactors continue to decline in numbers with an increase in "No visible lesions" on post mortem examinations. Lesions of tuberculosis were found in only 36.7 per cent. of reactors compared to 50 per cent. in 1959/60.

For various reasons, 792 head were tested out with agreement schemes, with three reactors being recorded.

The annual test on a large ranch in Matabeleland was again performed. 39,691 head were tested and the effect of the elimination of the "reactor" herd in 1959/60 was speedily apparent, only 211 reactors being recorded.

Total ranch incidence has declined as follows:

Year	1958	1959	1960
Reactors	1·19%	1·13%	0·53%

During the year 1,703 head had been tested on this ranch in respect of re-tests, sales and cattle proceeding to shows, and 59 reactors were found.

Of a total of 67,491 tuberculin tests performed within the Colony (excluding imports) reactors amounted to 335, giving a percentage of 0.49 per cent.

Meat Inspection Incidence:

		Bovine	*Porcine*
Cold Storage Commission —	Salisbury	38	4
	Bulawayo	21	79
	Umtali	1	2
	Ft. Victoria	73	—
TOTALS		133	85
TOTALS SLAUGHTERED		253,962	95,228

NOTES

Reactor Incidence

Salisbury: 14 cattle were reactors from tuberculin tested herds.

Bulawayo: 75 pigs were native owned, involving head condemnations only.

Fort Victoria: 60 cattle were reactors to tuberculin testing from a large ranch in Matabeleland.

Bovine Brucollosis (contagious abortion). Infection was confirmed on the following premises:

Veterinary Districts: Salisbury, 33; Bulawayo, 9; Umtali, 8; Fort Victoria, 8; Gwanda, 5; Chipinga, 1; Sinoia, 1; Gwelo, 1; total, 66.

Of the 4,447 samples tested, 317 proved positive. Testing this year was amplified with the check on vaginal tampon extracts effected by the Research Branch.

Propaganda continues in respect of the use of S.19 vaccine and sales this year have totalled 89,494, an increase of 17,000 from last year, but this is still a poor reflection of the willingness of stock-owners to take prophylactic measures in respect of this disease.

Quarter Evil (*Clostridium chauvoei*). Outbreaks were confirmed as follows:

Veterinary Districts	*Outbreaks*	*Deaths*
Bulawayo	13	19
Salisbury	86	736
Gwelo	15	109
Fort Victoria	14	281
Umtali	30	199
Chipinga	6	9
Sinoia	20	156
Gwanda	4	38
TOTALS	188	1,547

It is to be regretted that inoculation in the native reserve is no longer an annual routine as in the past. It is now an emergency measure in most cases, once deaths are diagnosed, and in one district alone we had to divert staff from other immediate duties to effect 50,000 inoculations to bring outbreaks under control. This is a common pattern throughout the country which it is hoped the propaganda in the Beef Export Drive will materially alter in both native and European areas.

Swine Erysipelas. Six outbreaks satisfactorily controlled with antibiotic therapy.

Two outbreaks of a sporadic nature in remote areas were controlled by slaughter.

Protozoal Diseases

Trypanosomiasis

The Senior Veterinary Trypanosomiasis Officer reports as follows:

The position varied over the whole country with serious new cases and new centres of infection in certain areas. In others the picture was static, showing the varying seasonal incidence.

Finally there were areas where a decline in the numbers of cases indicated an improvement.

The following table summarizes the use of drugs and cattle remaining in Trypanosomiasis areas.

(*a*) *North-Western* Front:	
Binga	6,092 cattle
Lupane	8,052 cattle
Gokwe	9,537 cattle
(*b*) *Zambezi Front*:	
Urungwe	1,847 cattle
(*c*) *North-Eastern Front*:	
Mtoko	4,079 cattle
Inyanga North	10,021 cattle
Holdenby	3,075 cattle
(*d*) *South -Eastern Front*:	
Chipinga	24,369 cattle
Fort Victoria	9,324 cattle
TOTAL	76,496 cattle

On prophylactic regime, i.e. Antrycide prosalt, 6,372; on curative basis, 70,124.

The next table shows the number of smears taken, confirmed cases and treatment given in all infected areas.

	Smears	*Positive*	*Inoculations*
(*a*) *North-Western Front*:			
Binga	5,937	43	10,642
Lupane	7,027	134	17,999
Gokwe	4,738	66	6,839
(*b*) *Zambezi Front*:			
Urungwe	12,202	10	239
(*c*) *North-Eastern Front*:			
Darwin	2,234	—	—
Mtoko	1,565	68	2,864
Inyanga	1,566	64	7,752
Holdenby	913	25	1,851
(*d*) *South-Eastern Front*:			
Chipinga	7,887	706	53,064
Ndanga	2,395	19	4,404
Bikita	3,174	222	7,875
Nuanetsi	1,367	41	2,244
TOTALS	51,005	1,398	115,773

The total figures again show an increase over the previous year.

	Smears	*Positive*	*Inoculations*
1958/59	38,734	930	91,421
1959/60	51,005	1,398	115,773

The positive smears were classified as follows:

T. vivax	892
T. congolense	498
Mixed	2
Untyped	2
T. brucei	4

(a) *North-Western Front*

Binga Native District. A satisfactory control has been maintained. A prophylactic regime using Antrycide Prosalt at three centres under heavy challenge and at two monthly intervals was successful.

Lupane Native District. Two new centres of infection were discovered at Maganganga and Ndimbili. The European property, Kana Block ranch was also infected from January.

Gokwe Native District. There was little new development. Routine smearing carried out with some improvement in organization.

Kana Headwaters proved to be infected for the first time since 1952 but the infection did not persist.

The North-Eastern area was placed under Prosalt cover. Half the total number of cases came from this sector.

(b) *Zambezi Front*

Urungwe Native District. No positive cases on European farms. The cattle introduced into the paddocked area during the previous year, 180 head, were closely supervised and returned two positive cases only.

By the end of the year the number of cattle in this area had increased to 440, the new entrants being under a closely supervised restocking scheme.

No positive cases were recorded from Lomagundi, Kariba or Sipolilo.

(c) *North-Eastern Front*

Darwin Native District. Inspection and smearing were maintained but no cases were recorded.

Mrewa Native District. No cases recorded.

Mtoko Native District. The 100 trial cattle introduced into S.N.A. "C" maintained excellent condition and returned one positive only.

Chikwizo Native Reserve. There was an increase in the number of positive smears. The infection appeared more widespread in the area.

Suspicion of Antrycide resistance was dealt with by the use of Berenil.

Mtoko Native Reserve. One positive case only reported.

Inyanga Native District. There was a deterioration in the position at the centre Fombe with confirmation of an Antrycide resistant strain of *T. congolense.* The strain was also resistant to Berenil and Ethidium but finally eliminated by Metamidium chloride. Chifambe showed mild infection, two positive smears being the first since 1958.

At Matisi a number of cases were recorded along the Gairezi River which at this point is the border between Rhodesia and Portuguese East Africa.

Holdenby S.N.A. Sporadic infection occurred at both Mandeya and Ruda.

Umtali Native District. Fifteen positive cases were noted from the European farms in the Burma valley. The last outbreak was in 1940 with an isolated case in 1947.

Cases were confirmed in African cattle and may have been the result of illegal movement between the area and P.E.A. Cattle raising is not an important industry in the area.

(d) *South-Eastern Front*

Melsetter Native District (Chipinga). The returns showed the highest number of positive cases ever, viz: 706. Only 59 of these cases occurred on European farms. Another good year in the highveld.

Of the 647 positive smears 211 were returned in one month from the P.E.A. border tanks, Mwangazi and Muumbe. At these centres the prophylactic cover was lifted in December and the spate of cases was noted during March. This gives some idea of the challenge in the area.

Later (September) three *G. pallidipes* were taken in the Muumbe area. Elsewhere the main cases were noted at the riverside tanks and those centres at the limits of the Mgangazi Muumbe area. From the mass of evidence available these two centres of infection do not appear to be related to any noteworthy degree.

The Mutema reserve returned four cases, the infected centre being 15 miles south of Birchenough Bridge. There has been no extension.

Chemotherapy once again held the position and deaths due to the disease were minimal.

Ndanga Native District (Ndanga East and Sangwe Native Reserves). Positive cases were low in number and sporadic in appearance not indicating any seriously increased threat.

No cases occurred on Lone Star Ranch. This fact seems to indicate the efficiency of the anti-tsetse measures undertaken on the Cheredzi River.

Bikita Native District. There was a most serious deterioration in the disease position reflected by the cases recorded on the European Devuli and Humani Ranches and extensions.

The infection was associated with the dense vegetation on the Sabi and Turgwe rivers. This extension was paralleled by the increased infection at the Sabi East riverside tanks.

The suspect areas on Humani and Devuli were, at the end of the year, the subject of a residual insecticide spraying exercise by Tsetse Control and the results as indicated by disease incidence are eagerly awaited.

Nuanetsi Native District (Matibi No. 2 Reserve). At Chibgwedziwa cases continued to appear throughout the year except during a period of four months following a block inoculation in November.

No infections were recorded at Chilonga.

Piroplasmosis (Redwater)

Confirmed on 113 properties with 159 known deaths—

District	*Properties*	*Deaths*	*Recoveries*
Salisbury	30	33	15
Bulawayo	14	36	—
Umtali	18	38	—
Gwelo	25	34	—
Fort Victoria	5	5	—
Chipinga	10	7	6
Sinoia	11	6	5
TOTALS	113	159	26

This disease is ubiquitous and most stock-owners readily recognized and treat it efficiently on their own initiative so that reported incidence is declining every year. Mortality mainly occurs in susceptible adult stock (graziers, etc.) which are introduced on to redwater veld without due consideration as to their immunity or otherwise. The specificity of phosphatic dips in killing blue ticks in all stages of development has markedly decreased the morbidity and mortality in such classes of stock, once the presence of redwater is recognized.

Theileriosis (Gonderia lawrencei)

Outbreaks were confirmed as follows:

District	*Centres*	*Deaths*
Salisbury	19	85
Umtali	2	24
Gwelo	1	32
Victoria	5	13
Chipinga	1	9
Sinoia	9	19
TOTALS	37	182

The policy of full control of Rhipicephalid flushes from the beginning of the tick season on all known old centres of this disease, plus similar control in contacts and other centres to which animals from known Theileriosis centres have been moved, has minimized spreads and mortality, as the following figures amply demonstrate:—

Year	*Outbreaks*	*Deaths*
1956/57	34	601
1957/58	22	437
1958/59	33	274
1959/60	37	182

The figures would have been even more convincing but for an unexpected late flush of brown ticks in the Salisbury District. Owing to late rains and tobacco reaping, this was not properly and immediately controlled, giving rise to thirteen new outbreaks.

FUNGAL DISEASES

Cutaneous Streptothricosis (Senkobo Skin Disease). Outbreaks continued in the Native Districts of Wankie, Lupane and Gokwe. This disease was the subject of a field survey with the tabling of the following findings.

Incidence is concomitant with the flush of biting flies (Tabanids, Stomoxys) at the height of the rains when hot humid conditions generally appertain.

The disease is generally associated with demodectic mange in cattle. It seems obligatory that skin traumata exist for the establishment of the disease. The vector role of biting flies was postulated and will be investigated next year. Ordinary kraal contact of cattle is of minor importance in the epidemiology.

Various fungicides were tried without success although 0.40 per cent. Teoquil (Allen and Hanbury) gave some control in mild cases. Application had to be extensive and repeated and it was economically of questionable value.

Majority of chronic cases had to be slaughtered due to depleted condition and general toxicosis. The actual mortality was very low in general.

Diseases Due to Mites

Demodectic Mange. The spread of this skin affection to cattle in the Salisbury District was confirmed, three European ranches and two Native Reserves being involved. Cases still occurred in Lupane, Nkai and Gokwe Native Districts.

The delta isomer of B.H.C. and one of the chlordane heptachlor series both gave good results in control.

Sarcoptic Mange

One outbreak in horses in Melsetter Native District.

Sheep Scab

Four outbreaks confirmed in Umtali, Gwanda, Chipinga and Sinoia, in sheep and goats; speedily controlled by B.H.C. dipping.

SCHEDULED DISEASES OF POULTRY

Viral Diseases

Fowl Pox. Sporadic outbreaks were seen in small flocks where the owner usually proved to be ignorant of the provision of a vaccine and its cheap availability. No high mortality recorded.

Newcastle Disease. No incidence in 1959/60.

Fowl Cholera. Three outbreaks were confirmed necessitating slaughter of 656 birds.

Fowl Typhoid. Confirmed on 16 premises, nine centres being liquidated by slaughter of the flock. Six were cleared by blood plate tests and slaughter of reactors. 5,824 birds were tested and 275 reactors destroyed. One premises still has to qualify for a final clearance test.

Bacillary White Diarrhoea. One hundred and twenty-eight flocks were tested with a total of 104,021 birds and certificates of freedom from disease issued. No outbreaks were confirmed in 1959/60.

Spirochaetosis. Three minor outbreaks in the Bulawayo Native District were confirmed.

Protozoal Diseases

Coccidiosis. The annual toll of this disease persisted in the four- to six-week-old chick class, giving heavy losses in many areas. The lack of control of this disease by small poultry keepers is the main limiting factor to their success in rearing purchased chicks, despite well publicized coccidiostatic drugs being readily available.

NON-SCHEDULED DISEASES

Ephemeral Fever. With the general overall lack of persistent rains, this disease was markedly reduced in incidence and of a very mild character.

Ophthalmia. This remained at a reduced level, exotic stock being mainly affected. Dipping in chlorinated camphenes and vitamin A supplementation has maintained a marked fall in occurrence in the lowveld ranching areas.

Vibrio Foetus. Over 2,000 mucus samples were examined and 220 positives demonstrated. Seventeen premises were found to be infected:

> Veterinary Districts: Sinoia, 1; Bulawayo, 2; Gwelo, 1; Salisbury, 13; total, 17.

Many of the premises previously recorded as infected have cleared up with the use of artificial insemination and antibiotic uterine irrigation of repeat breeders.

Paratyphoid. Disease incidence was low with lack of rains and contributory muddy calf kraals. Confirmed on three premises only. Calfhood vaccination increased in scope in the Eastern Districts particularly.

Coccidiosis. With the increase in submission of faeces for examination, this disease has been widely confirmed in cattle, sheep and in one herd of pigs. Mortality in open range calves has not been marked as in previous years.

Anaplasmosis. This disease is becoming rapidly established as the main factor in tick-borne disease losses and the lowering of condition in drought areas precipitated many severe relapses.

The following cases were confirmed:

> Veterinary Districts: Bulawayo, 117; Gwelo, 66; Salisbury, 51; Sinoia, 40; Fort Victoria, 27; Chipinga, 26; Umtali, 10; Gwanda, 4; total, 241.

These confirmations represent a mere fraction of total incidence.

Terramycin is giving good curative results in acute cases but too many are merely converted to sub-acute cases with under dosing and resultant fatal relapses are not being recognized as such.

Sweating Sickness. This was generally of a lower incidence but where non-dipping due to drought was prolonged into the calving seasons and bont-legged ticks thereby were not controlled (Midlands and North Matabeleland) the number of cases was rather high in calves but of a mild nature with few deaths.

Malignant Catarrh (Snotsiekte). Three outbreaks associated with presence of wildebeeste. One centre in Nyamandhlovu District reported 40 deaths, one showing Koch's Bodies as inclusions in spleen smears. The other two centres had only five deaths.

Myiasis. This is rapidly becoming a problem of the past in European areas with the use of organic acaricides but untreated cases in native areas still keep up potential reinfestation centres.

Horse-sickness. Many cases were reported especially in the Midlands area following the later rains. Five deaths were recorded, two of these being extremely late in the autumn when this disease usually does not occur.

Biliary Fever (Equines). Two cases only confirmed.

Verminosis. A major drive in internal parasite control has promoted general increase and interest in dosing by stock-owners. Survival in several near-drought areas was amply demonstrated to depend on the worm burden carried by stock and finally convinced many farmers of the necessity of worm control.

Statistical returns to farmers of fluke incidence in livers in cattle slaughtered at Government controlled abattoirs have promoted interest but have not given the end results anticipated in the adoption of routine dosing.

The numbers of submitted faeces samples increased markedly at all district offices and a keener approach to the economics of specific vermicidal programmes has been evinced.

In connection with the rearing of dairy calves in the high rainfall areas—where calves run on the traditional paddock system are subject to an extremely rapid build up in worm burden—it was proved that by placing calves in deep litter houses at birth, with no grazing, weights of 350-400 lb. could be attained at four to five months with dung samples almost negative despite no or minimal dosing. Control calves on the old paddock system, despite dosing, only attained about 50 per cent. of the weight gains in the same period.

Enterotoxaemia (Sheep). With the better class of sheep now being raised and increase in flocks fitted into ley rotations in tobacco farms, ignorance of the precipitating factor of sudden changes to high level feeds has provoked many outbreaks and deaths from this cause. The necessity for vaccination is being strongly stressed to all new sheep breeders.

Blue Tongue (Sheep). Most susceptible flocks were vaccinated but one outbreak in Chipinga District gave three deaths in imported German Merino sheep.

Orf (Ecthyma contagiosum). Confirmed in goats in Umtali District in a rather mild form.

Bowel Oedema (Pigs). This has become a major problem in all districts, especially in Umtali and many small breeders suffer heavy losses shortly after weaning. Very mixed results have been achieved by antibiotic therapy.

Virus Pig Pneumonia. The presence of this disease is strongly suspected but the pattern of pig-keeping is not conducive to its spread in the absence of intensive fattening houses. Rearing of small units in open houses plus high ambient temperatures also limits its occurrence. One intensive system, embarked upon in the relatively humid Eastern Highlands, produced a heavy mortality in piglets with lesions suggestive of V.P.P. in the survivors on slaughter, but the possibility of acute swine influenza could not be dismissed as a more likely diagnosis.

Avian Leucosis Complex. A heavy mortality occurred in laying hens in the Umtali District. This outbreak differed from the classical form of the disease in that marked drop in egg production followed by mortality was seen in second year hens in which no mortality had been experienced during the first season.

Elsewhere this complex still takes a heavy toll of poultry and a controlled genetical approach to its elimination is long overdue. Most poultry-keepers shirk the required culling of affected lines.

Histomoniasis in Poultry. This is gradually becoming more marked throughout the country.

Chronic Respiratory Disease in Poultry. One premises was tested out as clear in 1959/60 and this created a demand for others to be given the same facilities. Unfortunately a major block has supervened in the failure of supply of a reliable antigen.

DEFICIENCY CONDITIONS

Aphosphorosis. The recognition of this condition became widespread throughout the country and a very definite tie up with breeding deficiencies is emerging. The use of phosphatic supplementation in winter is rapidly spreading, even to African farmers in native purchase areas. Concomitant botulinism has been diagnosed on two ranching properties.

Transit Tetany (Hypomagnesaemia). Cases were seen in cattle ex Union of South Africa in transit to Northern Rhodesia.

Iodine Deficiency. Suspected in abnormal births in sheep and goats, in the Umtali District.

Vitamin A. This is now being generally identified as a deficiency in winter grazing throughout the country. Recorded as occurring in pigs in Gwelo District. The injection of Vitamin A in herds is now widespread to cover grazing deficiencies.

POISONING

Arsenic. The utter irresponsibility in the handling of arsenical dips is again stressed. In the face of impending visits by Animal Health Inspectors, gallons of dip are recklessly added and short-term dipping embraked upon to clean up tick infested herds, without thought to the over-strength solutions created thereby; resultant deaths and scaldings are commonplace.

Mortalities

Veterinary Districts: Salisbury, 346; Bulawayo, 123; Gwelo, 400; Umtali, 62; Victoria, 26; Chipinga, 25; Sinoia, 24; Gwanda, 15; total, 1,021.

Organics (Dips and Sprays)

Mortalities:	B.H.C.	119	
	Toxaphene	82	
	D.D.T.	25	
	Aldrin	30	(anti-malarial hut spraying)
	Phosphates	96	
	Total	352	

A recent survey into mortalities amongst calves belonging to the small cow-keeper hand-spraying with organics, revealed that calves were usually sprayed last with the over-strength residue in buckets. Fatalities from this procedure were not being reported as they were accepted as being due to "fits". In the environs of one of the larger cities, an approximate death rate of 200 to 250 calves was revealed from this cause in a twelve-month period.

Hand dressing with gross over-strength solutions of organics is a common death factor.

The delicacy of balance of emulsions of organics is underlined by the death of seven animals after dipping in a B.H.C. emulsion. It was demonstrated that the emulsion of the concentrate had split in the drums due to change of the metal from which the drum bung was manufactured.

Minerals: Lead, seven deaths; Sodium chloride, one death; Pentochlorophenate, three deaths (accidental consumption); Copper sulphate, one death; Cyanides, five deaths.

Anthelmintics:

Overdosing, 96 deaths.

Food Poisoning:

Urea Excesses, 42 deaths; Moulds, fermentation, etc. (silage, grains, etc), 30 deaths; Diplodia (maize contamination): Exact figures are unknown as so many farmers readily recognize this condition but plus or minus forty deaths were recorded.

Plant Poisoning: Three hundred and fifty-two known deaths were recorded.

Lantana camara was incriminated in major fatalities in Mashonaland, especially in drought relief cattle ex Matabeleland, and heavy loss of condition with a marked photosensitization was seen in survivors.

Dichapetalum cymosum (M'kauzaane) created major grazing problems in Nyamandhlovu, Bubi and the Bulalima-Mangwe Districts in late winter and early spring and the death rate must have been considerable.

Seneciosis (S. sceleratus) is showing marked toxicity in the Eastern Districts on early burns. If the area can be kept repeatedly mown until the grass comes through, the plant can be more or less eliminated, but this can seldom be done in this mountainous area.

Other plants incriminated in stock losses included Homeria, Moraea, Cestrum, Pteridium, Solanum and Veronia species.

ARTIFICIAL INSEMINATION

Three centres were operated, viz., Bulawayo, Gwelo and Salisbury. Only Bulawayo and Gwelo are dealt with, Salisbury being under the aegis of Research Branch.

Inseminations performed:

	1959/60	*1958/59*
Gwelo	886	635
Bulawayo	2,557	1,727
Totals ...	3,443	2,352

Towards the end of the year, a decline in bull power and inadequate finance for replacements lead to the trial issue of imported deep frozen semen from the Union of South Africa. The full repercussions of this change of policy has not yet been assessed but it is obvious that the dairy industry views this service mainly in the light of a livestock improvement measure and welcomes the greater range of bulls so made available.

If such a policy is adopted then it is obligatory for the participants to be willing to pay more for such an enhanced service.

One small co-operative artificial inseminating centre, supplied with deep frozen semen, has commenced operations in an outside district and this development is being watched with keen interest.

The greater availability of dry ice throughout the country is bound to give added impetus to such private centres.

BEEF EXPORT DRIVE

In conjunction with the other members of the Ministry of Agriculture, much propaganda work has been done at farmers' meetings, field days, etc., to raise the general standards of animal husbandry. In addition, small beef discussion groups have been formed and attended in co-operation with the Conservation and Extension Department, to make contact with farmers who usually do not attend general meetings. District campaigns have also been initiated at intensive conservation area group meetings by the introduction of animal health as a regular subject on the agenda.

Marked general progress has been made in regard to routine prophylactic vaccinations such as quarter evil, contagious abortion, etc., and formation of small district groups to organize 100 per cent. cover of these is encouraging. Increases in intensive dosing in respect of internal parasites with a greater appreciation of the need for supplementary feeding in winter in regard to general disease resistance and enhanced fertility have eventuated to everybody's gain.

It is hoped that these measures can be perpetuated and the enthusiasm of stock-owners fostered and retained.

In conclusion, my thanks are expressed to the staff of both Federal and Territorial departments with whom the Department of Veterinary Services has worked closely during the year.

I also wish to express my appreciation to all members of my staff who have so consistently given of their best, often under difficult circumstances.

STOCK SLAUGHTER FIGURES

	Cattle	*Pigs*	*Sheep and Goats*
Salisbury C.S.C.	98,030	50,151	13,051
Bulawayo C.S.C.	96,764	21,725	1,687
Fort Victoria C.S.C.	48,805	7,402	1,295
Umtali C.S.C.	10,363	15,950	2,815
Totals	253,962	95,228	18,848
Totals 1958/59	245,085	96,074	14,488

CATTLE CONDEMNATIONS

	Cattle	*Pigs*	*Sheep and Goats*
Salisbury C.S.C.	1,146	37	34
Bulawayo C.S.C.	1,034	677	—
Fort Victoria C.S.C.	1,044	59	6
Umtali C.S.C.	103	36	3
Totals	3,327	809	43

MAIN REASONS FOR CONDEMNATIONS

	Cattle	*Pigs*	*Sheep and Goats*
Emaciation and Oedema	1,889	40	30
Measles	584	656	—
Sarcocysts	223	40	—
Bruising	115	—	—
Pyaemia	46	—	—
Pleurisy and Peritonitis	224	20	—
Tuberculosis	35	4	—

Bovine carcases—minor measles incidence—detained for freezing—2,241 carcases. Measle incidence in pigs is mainly confined to those from native reserves killed at Bulawayo.

CATTLE CENSUS AND DIPPING TANKS

	European	Native	Total	Dip Tanks	Spray Races
Salisbury	348,744	343,714	692,458	1,434	388
Bulawayo	358,987	458,594	817,581	1,040	73
Umtali	67,712	175,545	243,257	476	84
Gwelo	276,127	267,270	543,397	896	50
Fort Victoria	222,788	429,935	652,723	649	19
Gwanda	119,317	276,891	396,208	345	7
Chipinga	53,404	51,915	105,319	245	12
Sinoia	125,836	63,742	189,578	344	114
Totals	1,572,915	2,067,606	3,640,521	5,429	747

EXPORTATIONS

	Northern Rhodesia	Bechuana-land Prot.	Mocam-bique	Swazi-land	Belgian Congo	Nyasa-land	South Africa	Angola	TOTAL
Bulls	141	—	50	—	27	4	5	14	241
Cows	515	—	166	—	—	4	25	105	815
Heifers	947	11	267	—	801	14	1	290	2,331
Calves	9	—	18	—	—	—	6	—	33
Oxen	1,353	—	50	—	—	—	—	—	1,403
Mixed Cattle . .	187	—	10	—	—	—	—	—	197
Mares	12	—	1	1	—	—	41	—	55
Stallions	3	—	—	—	—	—	13	—	16
Geldings . . .	92	1	6	1	15	2	48	—	165
Mules	—	—	—	—	—	—	—	—	—
Donkeys . . .	93	—	7	—	—	—	—	—	100
Pigs	23	53	53	—	—	11	3	—	90
Sheep	6	—	—	—	40	4	—	—	50
Goats	—	—	2	—	—	—	—	—	2
Slaughter Stock:									
Mixed Cattle . .	3,787	—	—	—	—	—	—	—	3,787
Sheep	2,027	—	—	—	—	—	—	—	2,027
Pigs	685	—	—	—	—	—	—	—	685
Goats	583	—	—	—	—	—	—	—	583
Oxen	356	—	—	—	—	—	—	—	356
								Total .	12,936

Bovine, 9,163; Equine, 336; Porcine, 775; Ovine, 2,077; Caprine, 585.

IMPORTATIONS

	South Africa	Bechuana-land Prot.	Northern Rhodesia	United Kingdom	America	Canada	Australia	TOTAL
Bulls	178	—	1	2	1	1	—	183
Cows	314	12	—	—	—	—	—	326
Heifers	611	—	—	—	—	—	—	611
Calves	41	5	—	—	—	—	—	46
Mixed Cattle . . .	70	—	—	—	—	—	—	70
Mares	201	—	—	8	—	—	—	209
Stallions	57	—	—	—	—	—	—	57
Geldings	476	1	14	—	—	—	—	491
Mules	108	—	—	—	—	—	—	108
Pigs	6	—	—	—	—	—	—	6
Sheep	694	—	—	—	—	—	—	694
Goats	—	8	—	—	—	—	—	8
Slaughter Stock:								
Bulls	—	7	—	—	—	—	—	7
Cows	—	73	—	—	—	—	—	73
Oxen	—	4,308	—	—	—	—	—	4,308
Mixed Cattle . . .	—	3,318	39	—	—	—	—	3,357
Pigs	—	1,725	656	—	—	—	—	2,381
Sheep	5,954	360	—	—	—	—	239	6,553
							TOTAL .	19,488

Bovine, 8,981; Equine, 865; Porcine, 2,387; Ovine, 7,247; Caprine, 8.

T. LEES MAY,
Assistant Director of Veterinary Services (Field).

REPORT OF THE ASSISTANT DIRECTOR OF VETERINARY SERVICES (RESEARCH) FOR THE YEAR ENDING 30TH SEPTEMBER, 1960

STAFF

Assistant Director of Veterinary Services (Research): G. J. Christie.
Chief Veterinary Research Officer: D. K. Shone.
Senior Veterinary Officer: R. M. Roberts.
Government Veterinary Officers: J. B. Condy, J. R. Philip.
Chief Laboratory Technician: G. E. Wells.
Laboratory Technicians: D. B. Vickers, D. H. Jones, S. M. Wortham (Miss).
Lay Inseminators: R. A. W. Price, J. S. Ward, O. Veldman, J. M. Selby (on secondment from Field Staff).
Station Superintendent: F. J. A. Waller.
Stockman (Gwebi): A. Craddock.
Administrative and Clerical Officer: G. W. Sansom.
Clerical Officer (Typist): E. H. Harrison (Mrs.).
Clerical Officer: W. E. Filsell (Miss).

R. M. Roberts proceeded overseas on a Food and Agricultural Organization Scholarship on the 28th March, 1960, to study techniques related to research into problems of reproduction and artificial insemination. He spent some time at the Royal University in Denmark, and also visited Sweden. The knowledge and information gained on this trip will prove invaluable in furthering our investigation into the reproduction problems of cattle in this country.

On the 27th August, 1960, J. R. Philip left for the United States of America under a partial International Educational Exchange and Fullbright Travel Grant. He has been granted six months study leave and will be absent for 12 months. He is studying poultry pathology at Kansas State College. The growing importance of the poultry industry in this country is reflected in the greatly increased number of post mortems undertaken, and a poultry pathologist is very much in need. Specialization has been increasingly noticeable during the last few years among staff, and indeed is encouraged, since it must eventually lead to a team of specialist officers having ability and experience to tackle problems on a much wider scale than the general diagnostician, who, while obviously a very necessary feature, has a relatively limited investigational field.

The need for a pathologist is becoming more and more apparent every year as the scope of our work increases. Histopathological examination is, in certain conditions, our only method of diagnosis. It is a most necessary adjunct to many of our investigations where bacteria, viruses and poisons alter the histological appearance of organs and tissues without any macroscopic variation. The presence of a pathologist at the Laboratory is considered essential in order to undertake fuller investigations into the varied problems with which we are presented.

Two of the technical assistant posts were permanently filled during the year with untrained personnel. A considerable amount of time has had to be spent by both professional and senior technical staff in training these officers.

The creation of a second S. & T.O. III post is extremely welcome and a very much needed addition. It is hoped that the remuneration offered on this scale will be sufficient to attract a technician with previous laboratory training.

The erection during the year of a mouse breeding house will relieve the previous constant problem of regular and adequate supplies of mice for the virological, and in particular, the rabies diagnosis, and for the rabies vaccine viability testing. In the past the colony was virtually decimated from time to time due to unsuitable housing, and rabies specimens requiring biologicals had to be held over until adequate numbers of mice again become available. This was particularly worrying when there was a case of human involvement.

ROUTINE SERVICES

The demand for the diagnostic services of the Laboratory continues. All staff are engaged upon routine services to some extent or other, some virtually whole-time.

There has been an increase in the number of specimens examined this year as compared with the previous year. The value of the diagnostic services would be greatly enhanced by the addition of a pathologist to the staff.

Diagnostic Services

A total of 13,628 specimens were examined during the year. These comprised:

Blood smears	313
Bacteriological examination — general	465
Agglutination tests on sera	4,331
Agglutination tests on tampons	2,404
Agglutination test on whole blood	2,353
Examination of milk for mastitis	673
Brain specimens for rabies	112
Sera for haemagglutination — inhibition test for Newcastle disease	120
Aborted bovine foetuses	71
Faecal specimens	93
Poultry post mortems	1,980
Sheep post mortems	124
Pig post mortems	85
Bovine post mortems	37
Rabbit post mortems	18
Dog post mortems	6
Guinea pig post mortems	8
Chinchilla post mortems	3
Bush pigs	5
Miscellaneous specimens	145

Post Mortems. A total of 2,270 post mortems were undertaken, this being an increase of 866 over last year.

	1959	1960
Poultry	1,291	1,980
Sheep	29	128
Pig	32	85
Bovine	9	37
Rabbit	41	18
Dog	1	6

Brucella Abortus. Agglutination tests on sera totalling 4,331 were undertaken, of which 297 were positive. As a routine a three-tube test is undertaken and positives are titrated to end point. A locally produced antigen standardized to international standard is employed.

Also undertaken were 2,068 agglutination tests on vaginal tampon extracts and 71 reactors diagnosed.

Bovine Foetal Specimens. Seventy-one bovine foetuses were examined. *Brucella abortus* organisms were isolated from six by cultures and by guinea pig biologicals, vibrio fetus organisms from three and *corynebacterium* from four. Seven were unsuitable for examination when received.

Vibrio Fetus. Agglutination tests undertaken on vaginal tampon extracts totalled 2,068, of which 222 were positive. The presence of the infection was diagnosed in 17 herds.

Trichomonas Foetus. Agglutination tests for trichomonas foetus, numbering 334, were all negative.

Rabies. Fifteen positive cases of rabies were diagnosed. One of these was a human case. The remaining 14 cases were all dogs.

Eleven cases were positive on a histological examination and a further four were positive on the biological examination.

A total of 112 specimens were examined histologically and 105 biologicals undertaken.

Two of the positive cases were in vaccinated dogs. One was vaccinated in 1960 and died on the 5th February, 1960. Vaccination here may have been done during the incubation period.

The second case was vaccinated in 1959 and died on 31st May, 1960. The diagnosis was confirmed by biological.

Tuberculosis. Thirty-four specimens submitted and 11 found to be positive either on direct smear examination or by biological in guinea pigs.

Tuberculosis tests were undertaken on 10 imported animals. All were negative.

Quarter Evil. Clostridium chauvoei was isolated from four specimens submitted. As the disease is readily diagnosed in the field, specimens are rarely submitted in any number.

Malignant Oedema. No case of malignant oedema was diagnosed during the year. The evidence does not suggest that *Clostridium septicum* is responsible for outbreaks of disease and routine vaccinations cannot be advocated. The occasional cases of malignant oedema due to wound infection with *Clostridium septicum* have been encountered, and a mixed quarter evil/malignant oedema vaccine is available when required.

Anthrax. Anthrax was diagnosed on two occasions from blood smears.

Calf Paratyphoid. Five cases diagnosed. The impression is that this disease is more widespread than is evidenced by the number of cases diagnosed.

Enterotoxaemia. There is a general increase in outbreaks of enterotoxaemia throughout the country. This is probably because of the greater movement of sheep which is taking place and the increased attention being given to supplementary feeds. Changes of diet and over feeding on high carbohydrate diets predispose to the disease. Eighteen cases of enterotoxaemia were diagnosed during the year. It is considered that the exposure of unprotected sheep at agricultural shows constitutes a risk.

Mastitis. Of 673 milk samples, 171 were positive for mastitis. A great number of dairy farmers have come to rely upon antibiotic treatment to the detriment of good hygiene. Many overlook the fact that antibiotics will not prevent infection, but as soon as the udder is free of the antibiotic it is once again fully susceptible to infection.

Poisoning. Specimens totalling 282 were submitted to the Chief Chemist for examination; 95 were positive for arsenic and one for lead poisoning.

POULTRY DISEASES

During the year 1,980 poultry post mortems were undertaken, an increase of 689 over the previous year.

Diagnosis:

Fowl typhoid	15
Fowl cholera	4
Coccidiosis	230
Roup	13
Fowl pox	21
Chronic respiratory disease	140
Infectious synovitis	2
Lymphoid leucosis	310
Neurolymphomatosis	95
Adeno-carcinoma	8
Other tumours	34
Histomoniasis	135
Nephritis	24
Cannabilism	4
Injury	56
Poisoning	16
Faulty management	248
Oophoritis and peritonitis	88

Cancer. A total of 447 cases of cancer out of a total of 1,980, a percentage of 22.6 per cent., presents a most alarming picture. It is apparent from these figures and from reports of outbreaks that little attempt is being made by the larger producers of day-old chicks to produce resistant strains of birds. We have, however, been able to persuade one chick producer that any attempt made to reduce the incidence of this condition would eventually prove of considerable benefit to him. It is hoped that this example will be followed in due course by other breeders. The majority of the larger poultry breeders do not submit birds for post mortem examination.

Chronic Respiratory Disease. The ravages that this disease may cause in broiler flocks have been observed on several occasions over the past year. Besides actual mortality there is a delay of up to three to four weeks in birds reaching market weight as well as greatly increased feed conversion factor.

Although this condition has been diagnosed on a considerable number of poultry premises, and the benefits of freedom from this condition have been publicized widely, the vast majority of our breeders are extremely slow to take advantage of Government services to eradicate the disease.

Newcastle Disease. Haemagglutination inhibition tests for Newcastle disease were undertaken on 57 serum samples collected from three flocks in the Salisbury area; all were negative. Sixty-three serum samples from Veterinary Research, Blantyre, were also examined; 14 were positive.

Several biologicals were also undertaken in fertile hen eggs, with negative results.

The sales of quarter evil vaccine continue to expand; 664,390 doses were sold, an increase of 22,900 over the previous year. This vaccine, which is produced at this Laboratory, is manufactured in batches of approximately 20,000 doses. A sheep immunized from each batch is subjected to a challenge of 100 lethal doses.

It is still a matter for comment that the use of vaccines is limited, especially so is this the case with quarter evil and contagious abortion.

Quarter evil is widespread in the country and the necessity for vaccination brought to the attention of the farmer more than any other disease condition of cattle, and yet the disease still causes heavy losses in recognized good farming areas. Several hundreds of cattle, for instance, are recorded as having died this year in the Mazoe Valley from quarter evil.

S.19 is an extremely effective vaccine and we stress that no owner of breeding stock should fail to use it, although it is not curative, the high measure of protection conferred by its use gives the farmer a remarkable level of security.

	1960	1959	1958
Quarter evil vaccine	664,390	643,400	479,415
Quarter evil malignant oedema	55,150	38,470	36,830
Horse-sickness vaccine	4,771	4,654	4,453
Redwater and gallsickness vaccine	9,666	7,295	8,456
Gallsickness vaccine	15,520	16,818	17,531
Contagious abortion vaccine	89,494	72,605	87,091
Anthrax Vaccine	282,380	169,210	300,461
Calf paratyphoid vaccine	4,820	5,984	6,270
Adult calf paratyphoid vaccine	290	355	410
Bluetongue vaccine	7,400	6,100	4,250
Enterotoxaemia	—	2,100	5,550
Rift Valley fever vaccine	50	650	2,525
Fowl pox vaccine	410,800	377,500	329,400
Remedies:			
Nodular worm remedy (tins)	462	41	583

QUARANTINE OF IMPORTED ANIMALS

Cattle:

Breed	*U.K.*	*U.S.A.*	*Canada*	*Holland*
Friesland	—	—	—	1 bull
Hereford	1 bull	1 bull	—	—
Jersey	2 heifers 2 bulls	—	1 bull	—
Red Poll	1 heifer 1 bull	—	—	—

The tendency of past years for the number of imported cattle to drop has continued this year—only ten animals passed through the quarantine stables.

It is extremely difficult to justify the retention of such a large amount of stabling—29 tie-ups—for these animals. It would be less restrictive on the work of the Laboratory either to erect special stabling for quarantine cattle or use the existing stabling at Gwebi Epi-Vag Station, thus freeing a complete block at the Borrowdale Road premises for disease investigation—a procedure more in keeping with the true nature of the Laboratory work.

Pigs. Two boars (one Large White and one Welsh) were imported from the United Kingdom.

Sheep. One Hampshire Down ram was imported from the United Kingdom.

REDWATER AND GALLSICKNESS IMMUNIZATION

Nineteen cattle were immunized against redwater and gallsickness. Nine were from Rhodesia and remainder from other countries.

ENTEROTOXAEMIA VACCINE

This is no longer imported from Onderstepoort for resale to the public as commercial vaccines are available at a cheaper rate.

BACILLARY WHITE DIARRHOEA ANTIGEN

Sufficient B.W.D. antigen was prepared and issued to test 107,680 birds.

These tests are undertaken by members of the field staff and reactors are forwarded to the Laboratory for the isolation of the causal organism. All vendors of day-old chicks must have a B.W.D.-free certificate.

No outbreaks were detected during the above tests.

ARTIFICIAL INSEMINATION

During the year a committee was set up by the Ministry of Agriculture to review artificial insemination in this country and to advise on the future of the service. The findings of this committee are still awaited.

In the course of the year 723 doses of deep-frozen semen were imported from the Transvaal Artificial Insemination Co-operative, 468 doses of Friesland and 255 doses of Jersey semen were imported. This semen was urgently required as one of the bulls had to be destroyed and another was temporarily out of commission.

	1959/60	1958/59	1957/58
Doses of Semen Used:			
Salisbury Inseminator	2,389	1,869	1,831
Bulawayo Inseminator	2,557	1,717	817
Gwelo Inseminator	886	635	347
Salisbury — Used by farmers	2,129	1,773	1,066
Bulawayo — Used by farmers	21	17	40
Gwelo — Used by Farmers	—	1	14
Salisbury Veterinary Department animals	54	74	86
TOTALS	8,036	6,086	4,201

	1959/60	1958/59	1957/58
Details of Semen Used:			
Doses of liquid Friesland semen	4,469	3,983	3,116
Doses (local) D.F. Friesland semen	2,200	1,385	624
Doses (imported) D.F. Friesland semen	468	—	—
Doses (local) D.F. Jersey semen	628	718	461
Doses (imported) D.F. Jersey semen	255	—	—
*Doses (imported) D.F. Red Poll semen	16	—	—

	1959/60 *Miles*	1958/59 *Miles*	1957/58 *Miles*
Mileage Covered by Inseminators:			
Salisbury	44,375	31,921	25,318
Bulawayo	39,247	28,708	14,147
Gwelo	8,436	6,319	4,316
TOTALS	92,058	66,948	43,781

	1959/60			1958/59			1957/58		
Revenue:	£	s.	d.	£	s.	d.	£	s.	d.
Salisbury	4,732	1	9	3,849	1	8	3,994	13	3
Bulawayo	3,212	0	0	2,302	15	0	1,033	12	0
Gwelo	1,085	16	0	792	19	0	462	7	0
TOTALS	£9,092	17	9	£6,944	15	8	£4,490	12	3

*Private import.

Centres. In the past year the Bulawayo centre has continued to operate purely on deep-frozen semen.

The Gwelo centre was changed over to deep-frozen semen when dry ice became available and, after some preliminary difficulties, appears to be operating satisfactorily. It is yet too early to assess whether any increase in the use of the service will take place. The number of inseminations undertaken at this centre compares favourably with the number of inseminations undertaken from the Bulawayo centre three years ago.

The staff position remains unchanged and there is considerable difficulty in arranging for relief for officers proceeding on leave.

The overall semen usage has again increased—the Bulawayo area being responsible for the greatest increase—namely, 840 doses.

In both the areas where the 25s. inclusive scheme has been in operation, there has been a decided rise in the mileage per insemination rate.

It was hoped, initially, that the increased inseminations in those areas would counteract the resultant increase in mileage.

Semen. The past year saw the inauguration of the importation of deep-frozen semen from the Union of South Africa. The semen was initially obtained as a pilot scheme to confirm that the conception results would be satisfactory, and indeed they were, but had to be extended, as semen could not be obtained from two of the Friesland bulls which left only one to meet the demands of a thrice-weekly collection service. One of the two bulls concerned had suffered an injury to the fetlock joint of a hind leg and the quality of the semen of the second bull became so poor it could not be used. Both bulls have now recovered and are again in use.

All the Jersey semen continues to be deep frozen and the innovation of the importation of Jersey semen from bulls whose progeny is registerable is extremely welcome, for the progeny of the bull available to us on loan are not registerable.

Bulls. M.V.W. Paul XIII was destroyed during the year owing to the development of a pathological condition of the hind legs. The straightness of the hock in some Friesland strains is a matter of some concern for it appears to be an hereditary factor.

One of the main points to be settled by the Artificial Insemination Committee is the question of keeping bulls at the present station or importing semen from outside the country.

There is no doubt that the importation of semen would give us access to proven sires, whether in South Africa or other countries, but at present the fact that the breed societies of South Africa, to whom Rhodesian breeders are allied, refuse to register progeny other than those of their own bulls, nullifies a considerable amount of the benefit our breeders would otherwise obtain from imported semen.

INVESTIGATION AND RESEARCH

The Poisonous Plants of Southern Rhodesia. Very little work has been undertaken in the past on the poisonous plants of Southern Rhodesia. Lists which have been compiled are based upon the fact that the plants occurring here have been found to be toxic in other countries. The well-known variation in toxicity of plants from one area to another make lists compiled in this matter most unreliable, and it was therefore decided that an examination of all plants known or suspected to be poisonous was extremely desirable. The plants were, in all instances, given by stomach tube after having been milled to a coarse powder. The test animals used were cattle, sheep and pigs, for the most part, and sometimes fowls.

It must be stressed that negative findings do not entirely exonerate a plant as being poisonous. It was found, for instance, that *Ranunculus multifidas* from Umvukwes was poisonous while that from Nyabira was not.

The following plants have been found to be poisonous:

Senecio sceleratus
Dichapetalum cymosum
Urginea burkei
Urginea altissima
Vernonia ampla
Combretum platypetalum
Nicotiana tobacum
Cestrum aurantiacum
Datura tatula
Solanum incanum
Solanum panduraeforme
Melia azedarach
Chironia transvaalensis
Bersama swynnertonii
Phytolacca dodecandra
Fungus — *diplodea zeac.*

Plants previously found to be poisonous and not part of this project:

Moreae zambesica
Sarcostemma viminale
Lantana camara
Phalaris tuberosa
Cynodon pletostachyium
Kavirando sorghum
Ergot of *pennisetum typhoides.*

It is hoped to have a comprehensive article completed for publication within the near future.

Redwater in Pigs. Investigations were undertaken into the susceptibility of the African bush-pig, *Potomachoerus porcus mashona,* to infection with *Babesia trautmanni.* It was established that the bush-pig suffered from an inapparent infection and the parasite was harboured in the bloodstream for up to 21 days.

The bush-pig may therefore be responsible for the propagation of this parasite in the absence of domesticated pigs.

Nitrate Poisoning. Previous work has shown a considerable increase in undiagnosed abortions in the country during July and August and, in view of the association between abortions and nitrate poisoning, this has led to an investigation into tests for the detection of nitrates and nitrites in blood and ruminal contents.

Such a test has been found and it is intended to screen all serum samples for nitrates and nitrites submitted from cows which have aborted. It is, of course, also possible to undertake examination of material in cases where stock are suspected to have died of nitrate poisoning.

Babecidal Drugs. (a) M. and B. 5062A. This drug was screened against *B. bigemina,* but owing to intercurrent infections a clear-cut result could not be obtained. It, however, appears to be effective and it is proposed to undertake a further screening trial in the coming year.

The drug showed no efficacy against *Anaplasma marginale* or *Gonderia mutans.*

(b) Berenil. This drug has been widely used as a babecide in dogs in this country. The death of a large number of dogs showing nervous symptoms was investigated and in the majority of cases it was found to be related to treatment for biliary fever with berenil two or three days previously.

The clinical symptoms were typical of acute renal failure, namely, muscular tremors, convulsions, twitching of the eyeballs. Post mortem examination showed the existence of a nephritis in all cases and blood urea determination on clinical cases showed greatly enhanced values. It is suggested that berenil in the presence of a pre-existing nephritis is responsible for the syndrome, and that this is due to acute renal failure.

Bowel Oedema in Pigs. Bowel oedema is probably responsible for the greatest number of deaths of weaners in this country. The epizootology, symptomatology and pathology closely resemble those described overseas.

In the course of investigations into this disease, cases have been reproduced with bowel filtrate from affected pigs, given intravenously to susceptible weaner pigs.

Numerous strains of *Escherichia coli* have been isolated from various outbreaks and submitted to the Central Veterinary Laboratory, Weybridge, England, for typing. The majority of strains have fallen into the classification E. 68—Group designation [0141 a(b) : K 85 (B) K X 1 (L)] which is the seratype most commonly isolated from cases of the disease in the United Kingdom.

In the course of this work a condition of haemorrhagic enteritis was encountered, which it is suspected may form part of the syndrome of bowel oedema.

Trichomoniasis. The vaginal mucus test for trichomoniasis antibodies was set up and over 300 samples screened, as it was thought that trichomoniasis may be responsible for infertility in some of the herds in this country. After initial problems regarding propagation and storage of the two strains and non-specific reactions the test proceeded smoothly. No positive reactions were encountered.

Anthelmintics. Neguvon A. An organic phosphorus anthelmintic is being marketed in this country for use on cattle and sheep. In a small trial its toxicity for sheep was demonstrated, three out of 12 sheep dosed died. This confirms the findings of workers in Australia, United Kingdom and the United States of America that the use of this drug for sheep cannot be advocated.

A large number of cattle have been dosed without ill effects.

Toluene. This drug has been used on a large number of horses and some transitory toxicity occurred. There were no fatalities and no after effects.

It was also used in cattle without ill effects.

Fascioliasis. Close contact is being maintained with the Bilharzia Research Laboratory in connexion with the snail eradication scheme, and any assistance requested is being given.

In a survey of *fasciola* infestation at the Cold Storage Commission abattoirs, it was found that the number of livers condemned did not reflect the infestation rate, for many livers are trimmed and passed. A survey of 2,005 livers was therefore undertaken.

No. of livers condemned	... ...	470 (23.44%)
No. of livers trimmed	... ...	502 (25.04%)
No. of livers not infected	... ...	1,033 (51.52%)
		100.00%

The total weight of trimmings of the 502 livers was 589.8 lb.; mean weight of trimmings in each liver, 1.175 lb.; incidence of *fasciola* infestations in 2,005 animals, 48.48 per cent.

Snails of the genus *Physa* from the Umtali district appeared to resist infection with *Fasciola gigantica miracidia.*

The effect of *Fasciola gigantica* infestation on the weight gain of sheep was studied. The weight gain of infested animals was considerably slower than the uninfested controls.

Seasonal Variation in Worm Egg Content of Sheep Faeces. The study on the seasonal variation in the worm egg control of sheep faeces continued. The post-parturient rise remains the most marked feature of these observations.

This project is being extended to observe how early lambs acquire infestation and the severity of these infestations in lambs born in spring and autumn, and also the effect of lambing at these times on the post-parturient rise.

Stilesia Hepatica. During the year several anthelmintics were screened for their activity against *Stilesia hepatica.* None of them were successful. The anthelmintics screened were:

Dichlorophen
Bephenium embonate
Hygromycin
Neguvon A.

Vibriosis. A haemagglutination test for vibrio fetus described by workers in New Zealand and reported to be more sensitive than the agglutination test was compared with the agglutination test in use by us.

In our hands we found the haemagglutination test to be no more sensitive and there were practical disadvantages which the agglutination test did not possess.

Preliminary work was instituted into the role vibrio fetus infection plays in infertility in ranch herds.

Infection has been diagnosed in some ranch herds but considerably more work requires to be undertaken before the importance can be assessed. With the absence of officers overseas this work is in abeyance.

Brucellosis. Work on the use of the tampon test for the diagnosis of brucellosis was continued during the year. Two cows which had given positive results to the tampon test but were negative for serum antibodies were obtained for further work. Both cows were inseminated and one has calved down. Extensive cultures and biological examinations of vaginal discharges, placenta, calf stomach and milk were negative for brucellosis. It can only be presumed that in this instance the agglutination was due to non-specific causes.

Low Fertility in Ranch Cattle

This work continues to be carried out at Charter Estate with the active co-operation of the manager, Mr. David Worthington.

Previous work has shown the importance of management in its widest sense and it is felt that considerable improvement in our calf crop can be achieved by attention of this aspect.

(1) *Calving Interval.* In view of the fact that approximately 96 per cent. of Africander heifers calve down as a result of bulling at three years old and the greatest fall in calving precentage occurs during the second calf crop, a trial was considered necessary to gauge the effect of varying the bulling interval.

Groups of mixed two- and three-year-old heifers were used; one group was given an interval of 13½ months, i.e., mid-November to the following January; one group 20 months, i.e., January to the following August, and a third group were controls to cover seasonal variation, i.e., 12 months from January to January.

Unfortunately, because of the very poor season, it proved necessary to commence feeding, all groups with 3 lb. per head 30 per cent. protein cubes just before calving so that in point of fact the 13½-month interval group received 40 feeding days more than the other two groups.

The 13½-month interval group, when pregnancy diagnosed in May, showed at least a 40 per cent. higher conception rate than the 12-month interval group. In view of the fact that feeding had to be undertaken in both groups it is difficult to assess the true effect of the increased bulling interval, and this trial must obviously be repeated.

However, it is worth recording that—

(1) The early calving group showed a considerable increase in conceptions over the normal interval bulling group.

(2) The average weight of calves at weaning in the early calving group was 346 lb. as compared with 269 lb. in the control group.

The pregnancy diagnosis of the 20-month interval group is scheduled to take place in November, 1960.

(2) *Twice-a-year Bulling.* The introduction of two bulling periods, namely January/March and August/September, is considered to raise the calf crop 10 to 15 per cent.; we have also found this so.

The following further work was undertaken:

Groups of cows with first calves at foot which had failed to breed at the January/March bulling were divided into three groups.

(1) Fed 3 lb. protein cubes from 1st April.

(2) Fed 3 lb. protein cubes from 1st June.

(3) Unfed controls.

Following an August/September mating the conception rates were: Group (1) 66 per cent.; group (2) 64 per cent.; group (3) 5 per cent.

This indicates that an increased dry season conception rate can be achieved by "flushing" but to become economic the period of flushing requires considerable reduction.

MISCELLANEOUS

Publications by Staff

Philip, J. R. (1960). "Oedema Disease of Swine."
Rhod. Farmer, vol. 31, No. 3, pp. 42–43.
Shone, D.K. (1960). "Ergot of Munga as a Cause of Agalactia in Sows".
Rhod. Agric. J. 57, 120–121.
Philip, J. R. (1960). "The Use of Chemotherapeutic Agents in the Treatment and Control of Poultry Coccidiosis".
Rhod. Agric. J. 57, 308–310.
Condy, J. B. (1960). "An Observation on the Efficiency of some Anthelmintics against *Fasciola gigantica*".
Vet. Rec. 72, 196.
Anonymous (1960). "Gallsickness Vaccine".
Rhod. Agric. J. 57, 318.
Condy, J. B. (1960). "Bovine Schistosomiasis in Southern Rhodesia".
Cent. Afr. J. of Med. 6, 381.
Anonymous (1960). "The Control of Sheep Parasites".
Rhod. Farmer 30, No. 44, p. 30.
Anonymous (1960). "Horsesickness".
Rhod. Agric. J. 56, 184.

Papers Submitted for Publication

Shone, D. K. and Philip, J. R. "The Susceptibility of the African Bush Pig, *Potomachoerus porcus mashona* (Lonberg), to Infection with *Babesia trautmanni*".
Condy, J. B. and Carr, W. R. "Observations on the Serum Proteins of Afrikander, Mashona and Mgami Cattle".
Philip, J. R. "Chronic Respiratory Disease of Poultry".
Philip, J. R. and Shone, D. K. "Some Observations on Oedema Disease and a possibly related condition of Pigs in Southern Rhodesia".

ACKNOWLEDGEMENTS

I wish to acknowledge the willing and enthusiastic co-operation of the staff throughout the year under review, and to thank those other departments which have rendered assistance for our investigations.

G. J. CHRISTIE,
Assistant Director of Veterinary Services (Research).

REPORT OF THE DIRECTOR OF TSETSE AND TRYPANOSOMIASIS CONTROL AND RECLAMATION FOR THE YEAR ENDED 30th SEPTEMBER, 1960

I. GENERAL REVIEW

Organization. The absorption of the Department into the Department of Veterinary Services, foreshadowed in the previous year's report, has not yet been place, although Government's intention in the matter was announced by the Federal Minister of Agriculture in July, 1960.

A small research station has been built on the Rekomitjie River, in Urungwe, approximately 25 miles from the Zambezi. Dense populations of both *G. morsitans* and *G. pallidipes* are easily accessible and some of the results already obtained at Rekomitjie are described below. Work has begun on a somewhat similar station at Lusulu, in Binga District, although here the main object of study will be the veterinary control of trypanosomiasis in cattle rather than the entomological attack on its vector.

The mapping section of the Department has continued to expand and additional accommodation has been acquired to house it.

Considerable improvements have been effected in living conditions of field staff. The first District Entomologist's house has been completed at Gokwe. This is in pursuit of a policy of stationing entomologists where they will be in close contact with the local Native Commissioner and also with district veterinary staff. Elsewhere the Department now possesses twelve 2- or 3-bedroomed houses usually constructed of Kimberley brick or concrete blocks. Two more are in course of preparation, but several officers are still housed in Altents.

Staff. The professional officer strength is still three short, that is, instead of seven biologists in the field we have four. Nevertheless, very good progress has been made in the task of introducing new techniques of tsetse control and great enthusiasm has been shown by the Field Officers in the new work. The building up of a corps of trained Field Assistants, which should now be enlarged, has gone well and for them, as for the Field Officers, courses at Rekomitjie Field Station have been most useful. In certain areas, where tsetse flies are very rarely seen, it is difficult to train new men and there are obvious advantages in being able to send them for preliminary instruction to a station where tsetse are abundant.

The Tsetse Situation. Progress in creating an adequate system of defence along the fly-front has been good and such adverse changes in the trypanosomiasis situation as have occurred have been adequately dealt with by the organizations available.

It has been possible to begin to implement the policy of replacing game destruction by other techniques. In January all shooting in the Sabi Valley area ceased and in September the decision was made to cease hunting in Binga District and in Gokwe west of the Mafungabusi Plateau. The hunters will be disbanded at the end of October, 1960. In part this decision has been reached because it has become evident that very large numbers of game animals still remain to be destroyed between the Sebungwe fences before an adequate defence system can be established. During the last year hunting has been intensified in the hope that we should see at least the beginning of a decline in the numbers of animals shot. This hope has not been realized. (Details of game shot are given in Appendix I.) At the same time a recent trial in the use of dieldrin sprayed on the resting places of *G. morsitans* in the Maseme basin, in Binga District, although not concluded at the time of writing, is giving results sufficiently promising to indicate that we can use the method as a means of control sufficiently rapid to deal with local advances of tsetse. This follows the successful use of this insecticide in controlling trypanosomiasis on the Chiredzi River in Ndanga last year.

In the Sanyati area (Gokwe District) a game fence has been completed and considerable progress made in surveys of the tsetse infested area north of the control zone. In Urungwe advantage is being taken of the present favourable situation by the Native Department, in collaboration with the Department of Veterinary Services, to implement a scheme for the reintroduction of cattle to the Urungwe Native Reserve. In North Lomagundi there has been no change in the position, the tsetse being confined to country below the Zambezi escarpment where it remains harmless to cattle on the Doma farms.

In Mtoko District also there has been no change, though here also experimental local trials of more intense hunting methods have shown that other methods of control should, in due course, prove easier to use. Cattle in the Chikwizo Reserve are being successfully maintained under drug protection in the presence of a light, but detectable, tsetse infestation. Immediately south of the Mtoko area attention has been directed to Inyanga North where, just south of the Ruenya River, cattle have been under drug cover for some years. It is evident that the Ruenya, like the Nyamsansara and Mudzi Rivers further north, acts as a path by which *G. morsitans* invades from across the Portuguese border. A new station is to be opened here shortly.

On the Chipinga border clearing the position remains satisfactory. During the year trials on the use of arboricides for scrub control have continued. Further south, in the Sabi area, where the tsetse front runs through South Chipinga, Bikita, Ndanga and Nuanetsi Districts, progress in survey work and in defence line construction has been good, and it now appears that we have at length elucidated the cause of the extensive cattle infections in the neighbourhood of the Musikuvanthu Reserve. Over a year of continuous survey with bait cattle has revealed the presence of *G. pallidipes* in the Mwangazi gap and there can now be little doubt that this fly is the principal vector of an infection which extends from the Portuguese border across the Sabi into the ranches of Devuli and Humani. In these ranches infections this year have been more numerous than at any time hitherto. Accordingly an intensive spraying operation in the dense bush fringing the Turgwe and Sabi Rivers in this area was carried out in August. It is too early yet to assess the results which, it is hoped, will follow the pattern of a similar, though smaller scheme on the Chiredzi last year, where insecticide treatment resulted in the immediate disappearance of infection. Meanwhile the bush clearing operations west of the Sabi have been intensified and a team of five bulldozers is now at work. The clearing programmes on the Mkwasine and Chiredzi Rivers has been completed and the next phase of the programme south of the Lundi River has begun. On the east bank of the Sabi a discriminative clearing and fencing scheme north of the Makossa Hills tsetse concentration has been completed. A very creditable achievement has been the completion of vegetation mapping of the whole Sabi fly-belt and fly-front on a scale of 1 : 40,000, covering an area of nearly 4,000 square miles.

Although still over forty miles away, a matter of some concern is the advance of *Glossina morsitans* which is approaching Southern Rhodesia along the Chobe River, the border between the Bechuanaland Protectorate and the Caprivi Strip. This movement is part of a general spread of this tsetse which, accompanied in the Caprivi Strip by an epidemic of sleeping sickness, is affecting the two territories mentioned as well as Angola and Northern Rhodesia. Steps are being taken to co-ordinate action under the aegis of C.C.T.A.

Human Trypanosomiasis. Four cases of human trypanosomiasis were reported amongst Africans during the year under review, of which one was fatal. Three cases, including the fatal case, were probably infected at Nvurundura in the Gokwe District. The fourth case occurred at Kariba and was probably a local infection.

This latter case points to a problem which already demands attention. The airport at Kariba, at the approach of hot weather in August-September, forms an artificial "feeding ground" for tsetse in which visitors are liable to attack. There are other places in the neighbourhood of the lake where *Glossina* is abundant. The chances of a visitor becoming infected with sleeping sickness are remote and today even well advanced cases can be cured; nevertheless a survey of the Kariba area with a view to planning operations which will reduce the intensity of attack is urgently needed. It is hoped to station an entomologist at Kariba in the near future. This officer will also be concerned with watching the behaviour of the tsetse population when the lake level is stabilized.

Traffic Control. The number of traffic control points has been reduced to 26. The gates which caught few tsetses have been removed in the interests of economy. The obvious result is that the flies carried per 100 vehicles or pedestrians shows an apparent increase over recent years.

Cycles are now the most efficient carriers of tsetse to the control points. Flies carried per 100 cars were 0.7; per 100 cycles 10.7 and per 100 pedestrians 1.9. In the Sebungwe at Siambola Gate southbound cyclists carried an average of 6.6 flies each during the year. Details are given in Appendix 2.

Fences. Considerable use is made of stout fences constructed of hard wood poles and eight strands of high strain steel wire, to exclude larger game animals from areas where anti-tsetse operations are in progress. Breaks are caused in the fences, but animals quickly become aware of the barriers and where recently erected fences are established the number of breaks recorded per month soon declines. As an added deterrent, white-painted iron discs are hung at intervals along the fences. The appearance and noise of the discs discourage animals from coming into contact with the fence.

A total of 419 miles of fence is maintained in good repair. In most cases roads follow the fences, so that adequate inspection and attention may be afforded. This year 78 miles of new fences were built.

Roads. The work of constructing roads and tracks to our less accessible areas has continued. Efforts are being made to provide simple mechanical equipment to improve the condition of these roads and to accelerate the development of communications.

Approximately 200 miles of new roads were constructed during the year bringing the total mileage of roads maintained by the Department to 1,500. These roads are generally only suitable for four-wheel drive vehicles.

Distribution of Expenditure. The following table analyses the bulk of expenditure in the field, during the financial year July, 1959, to June, 1960. It does not include the costs due to the headquarters office nor salaries and allowances of permanent staff, European and African. Camp construction covers the special building programme mentioned above and this item therefore receives a much higher proportion of expenditure than is normal. Game destruction still accounts for the largest employment group, although bush clearing and bush control, chiefly in the Sabi mechanical clearing scheme, accounts for the largest total expenditure and, probably, the largest contribution towards permanent exclusion of tsetse fly. Expenditure on insecticides covers only the Chiredzi River operation of September, 1959. It does not cover the Maseme and Turgwe River operations reported on below.

PERCENTAGE DISTRIBUTION OF COSTS BETWEEN
DIFFERENT TYPES OF OPERATION

Type of Operation	Labour	Equipment, Stores, etc.	Transport	Total
Bush clearing and control	14·8	58·8	1·1	34·8
Game destruction	42·4	3·0	30·3	22·2
Surveys and investigation	7·7	3·2	8·4	5·6
Insecticides, arboricides, etc.	1·7	8·8	0·9	5·1
Traffic control	8·6	0·9	5·3	4·5
Fences	3·2	5·2	4·4	4·3
Roads	3·7	0·7	2·1	2·1
Administration	8·9	4·0	22·8	7·8
Camp construction	7·4	13·4	12·0	10·8
Miscellaneous	1·6	2·0	12·7	2·8
TOTALS	100·0	100·0	100·0	100·0

Research and Investigation. The Department is not at present concerned with fundamental research. The investigations it carries out are devised with the object of obtaining data which will allow us to take full advantage of fundamental research carried out elsewhere. If we are to apply the results of such research efficiently we must understand as fully as possible the details of our local trypanosomiasis problem. Thus in order to make the best use of insecticides it is necessary to understand the behaviour of *Glossina morsitans* and *Glossina pallidipes* in Southern Rhodesian conditions. If we are to make the fullest use of antitrypanosomal drugs we have to understand the nature of Southern Rhodesian trypanosomes and the epizootiology of trypanosomiasis in Southern Rhodesian cattle. The investigations we are now undertaking are directed towards these ends and fall into several groups.

(1) The description of the vegetation of fly-belts and the relationship between it and tsetse distribution.

(2) The study of the use made by the tsetse of the bush it inhabits, in particular the sites used by the resting insects, since these indicate where to apply insecticides.

(3) The study of the frequency in *Glossina* of infection by the three main groups of trypanosomes both seasonally and locally and the reservoirs of these infections.

(4) The distribution of trypanosomiasis and its seasonal incidence in cattle and, related to this, a study of the distribution of biting flies other than tsetse which may be of importance in the so-called "mechanical tranmission" of the disease.

Also under the heading of investigation should be included studies of techniques. Thus the use of shotguns as a means of speeding up game destruction led to the conclusion that rifles at a density of one per ten square miles were achieving a degree of elimination which, in respect of certain more abundant species, was no longer resulting in reduction. Use of other weapons, instead, as was hoped, of bringing about a quick reduction, merely increased the kill which remained at a high level without bringing about further reduction, while in certain areas tsetse numbers remained high. These observations supported the decision to turn to insecticides rather than to persist with a technique which, at best, could only yield results very slowly.

In the use of insecticides much remains to be learnt. Problems which emerge in the early trials include not only those which are primarily entomological, that is, chiefly, where to put the insecticide, how long it persists at a strength capable of killing *Glossina,* and so on, but also the logistics of managing spraying operations in country generally without roads and with limited, often sparse, water supplies. Some of these problems are dealt with below.

CONFERENCES AND MEETINGS

The Director addressed the seventh Commonwealth Entomological Conference in London in July on recent advances in tsetse fly and trypanosomiasis research and reclamation and in August attended the Eighth Meeting of the Interterritorial Committee for Scientific Research on Trypanosomiasis held at Jos, Northern Nigeria. In company with the Director of Veterinary Services he also attended a meeting in Lusaka of officers of various departments from the three territories to discuss possible fields of tsetse and trypanosomiasis research in which the Agricultural Research Council might give assistance.

Provincial and district trypanosomiasis committees have met in Fort Victoria, Karoi and Chipinga, while the Trypanosomiasis Control Committee has continued its monthly meetings. The Department was represented at a meeting to discuss the development programme for Binga District. By courtesy of the Chief of the Missao a Combate as Tripanossomiases, two entomologists from the Sabi area made a most useful visit to the Sitatonga Hills in Moçambique where they had the interesting experience of collecting, in one hour, specimens of *G. morsitans, G. pallidipes, G. brevipalpis* and *G. austeni.* This mixed fly belt abuts on the border of Chipinga District, but tsetse density is low and, except in Portuguese territory, there is no opportunity to see the main habitats of *Glossina.*

PUBLICATIONS, ETC.

The following papers have either been published, accepted for publication or delivered to scientific meetings during the year:

1. Cockbill, G. F. (1960). "The Use of Records from Traffic Control Points in Southern Rhodesia." Rep. Seventh Meeting I.S.C.T.R., CCTA Publication No. 41, p. 231.
2. Cockbill, G. F. (1960). "The Control of Tsetse and Trypanosomiasis in Southern Rhodesia." Proc. and Trans. Rhod. Sci. Ass. XLVII, p. 1.
3. Farrell, J. A. K. (1960). "The Control of a Tsetse Fly *(Glossina)* Advance by use of Residual Insecticide." Eighth I.S.C.T.R., Jos, Nigeria.
4. Ford, J. (1960). "A Note on the Location of *Glossina morsitans* Westw. on Transect Fly Rounds." Rep. Seventh Meeting I.S.C.T.R., CCTA Pub. No. 41, p. 237.
5. Ford, J. (1960). "The Influence of Tsetse Flies on the Distribution of African Cattle." Federal Science Congress, Salisbury.
6. Ford, J. (1960). "Recent Advances in Tsetse and Trypanosomiasis Research and Reclamation." Seventh Commonwealth Entomological Conference, London.

7. Ford, J. (1960). "The Advance of *Glossina morsitans* and *Glossina pallidipes* into the Sabi and Lundi River Basins, Southern Rhodesia." Eighth I.S.C.T.R., Jos, Nigeria.

8. Goodier, R. (1960). "Some Effects of Bush Clearing in Southern Rhodesia." Rep. Seventh Meeting, I.S.C.T.R., CCTA Pub. No. 41., p. 241.

9. Leggate, B. M. and Pilson, R. D. (1960). "The Diurnal Feeding Activity of *Glossina pallidipes* (Aust.) in Relation to Trypanosome Challenge." In press, Bull. Ent. Res.

10. Lovemore, D. F. (1960). "*Glossina pallidipes* in Southern Rhodesia's Northern Tsetse Belt." Rep. Seventh Meeting I.S.C.T.R., CCTA Pub. No. 41, p. 235.

11. Pilson, R. D. and Leggate, B. M. (1960). "The Diurnal Activity of *Glossina pallidipes* (Aust.)." Eighth I.S.C.T.R., Jos, Nigeria.

ACKNOWLEDGEMENTS

Again the Department is indebted for much assistance; especially from the Department of Native Affairs, the Department of Wild Life Conservation, the Department of National Parks, the Department of Conservation and Extension and the Department of Veterinary Services, with the last of which we hope shortly to be united. The Trypanosomiasis Control Committee has continued to give its valued support and we are grateful to members of local committees whose deliberations have been of great value.

Finally the enthusiasm and loyalty of all members of the Department is acknowledged with gratitude and appreciation.

J. FORD,
Director.

II. DISTRICT REPORTS

(1) THE ZAMBEZI FLY BELT

by D. F. Lovemore, *Entomologist*

Introduction

In order to obtain a co-ordinated system within the Zambezi Tsetse Belt all tsetse operations within this area have been placed under the control of a field entomologist stationed in Salisbury. The intention is to develop a single continuous defence organization along the entire tsetse front. Such organization is an essential preliminary to any large-scale attack on the tsetse (Map No. 1).

Progress during the year has generally been satisfactory. The chief difficulties have been the many differences in approach between the various similar operations and the lack of professional staff. These problems are gradually being overcome.

The effect of stationing the field entomologist in charge in Salisbury has been to attain a liaison between the field and headquarters of an order which has not been previously possible.

The Sebungwe area is the scene of the largest operation, with a senior field officer and four field officers. Here hunting operations were intensified during the year, but without the desired result, for it had been anticipated that this year should see a marked decline in tsetse density in the operations area. A western movement of tsetse has been dealt with by extensions of the game fence and an attempt to control game movement. At the same time, a very successful insecticide operation in the Maseme area has eliminated the tsetse population from which this advance originated. The success of this campaign has led to proposals to cease game destruction in the near future in favour of the use of insecticides as the main weapon of control.

In Sanyati the operations area has been fenced off and a new camp built for another officer to assist the senior field officer who hitherto has run the area single handed from a station at Copper Queen.

The generally satisfactory situation throughout the Urungwe has continued. Only 11 cases of animal trypanosomiasis were diagnosed during the year; these included eight positives amongst native-owned cattle on the Crown land to the north-east of Miami, two amongst the cattle recently reintroduced to the Urungwe Reserve and one donkey at Zwipani.

Control operations in progress throughout the year have included hunting in Urungwe West and Urungwe North and East, road development and traffic control.

Rekomitjie Field Research Station is beginning to prove its value. Some very interesting work has been carried out during the year and it has been invaluable as a training centre for both European and African staff.

Various building projects to provide living accommodation for both Europeans and Africans and office and laboratory accommodation were undertaken at Rekomitjie, Makuti and Kariba.

A senior field officer is stationed at Makuti. He is assisted by two field officers in charge of control operations. A third field officer is stationed at Rekomitjie to look after routine investigational work, to assist the entomologist and to organize the training of field assistant recruits.

The single field officer in the North Lomagundi area has been mainly concerned with opening up a road system in this generally inaccessible part of the country.

A. Sebungwe (Binga and Gokwe Native Districts)

1. *Hunting Operations*

The hunting operations, which were designed to create a game- and tsetse-free belt north of the settled Lutope, Kana, Mzola and Lubimbe areas, were carried out efficiently during the year, but contrary to the optimism expressed in last year's report, the results were disappointing.

The hunting was continued on the same lines as described in the 1957/58 and 1958/59 reports, the only differences being a slight decrease in the number of regular .303 hunters, these varied in number from 111 to 123 as compared with 120 to 130 in 1958/59) and an increase in shotgun hunters (these were increased from 12 to 23 in March and then to 50 in April as compared to 5 to 12 in 1958/59). The increase in shotgun hunters resulted in an improved "hunter coverage" of the area, especially in the Cewali section, where 25 of the shotgun hunters operated. It also intensified considerably the attack on the smaller game animals. All the hunting was supervised by one senior field officer and four field officers. Elephant control was carried out by the senior field officer. No calls for assistance had to be made on officials of the Departments of Wild Life Conservation or National Parks. The game fence was maintained in good order throughout the year. Once again there were comparatively few breaks-through by game.

The 30 "bicycle" fly-rounds which cover the shooting operations area and the two controls which lie to the north of the area were carried out regularly by a team consisting of one field assistant and 12 casual "fly-boys". About 500 miles of road were maintained and some 10 miles of new road were cut.

10,033 game animals and 14 elephant were destroyed within the operations area during the period under review. This represents an increase of 2,859 in the case of game animals and a decrease of 46 in the case of elephants. Shotgun hunters accounted for 3,951 head of the total game animals destroyed at an average of 10.59 animals per hunter per month, whereas .303 hunters shot 6,082 animals at an average of 3.94 animals per month. Ammunition expenditure was at the rate of 1.85 rounds per animal for shotguns and 3.12 rounds per animal for .303s.

The increase in game animals destroyed is chiefly the result of the intensification of hunting of small game with shotguns by night. The increase over last year's total of the combined totals of duiker, steenbok and Sharpe's grysbok more than accounts for this increase:

Duiker	1958 - 59	549
	1959 - 60	2,671
Steenbok	1958 - 59	76
	1959 - 60	339
Grysbok	1958 - 59	57
	1959 - 60	395.

It should however be noted that the .303 hunters accounted for 3 per cent. more head of small game than they did last year and also that the totals of the various larger game animals destroyed were generally less than those for last year.

The wart-hog kill for the year was 772 head, which is only 51 head less than last year. This was disappointing, especially in the light of the observations made in last year's report that the wart-hog population appeared to be on the decline, a reduction in the order of 50 per cent. having been suggested. The kills of bush-pig and reedbuck showed marked increases on those for last year; in the order of 20 per cent. and 50 per cent. respectively.

It would be as well at this stage to discuss the hunting results in relation to tsetse figures obtained from fly-rounds throughout the area. The fly-rounds, which have now been in operation for well over a year, indicate no obvious change. It was quite unexpected that this intensive hunting, which had been continuous over a period of two-and-a-half years, should have made no impression on the tsetse population. Control has been obtained over elephant and considerable inroads have been made into the larger game animal populations but evidently there has been little effect on the smaller game animals. The persistence, perhaps even the increase, of smaller buck is not likely to have accounted for the failure of the tsetse population to collapse, a conclusion strengthened by the analysis of blood meals published below. A recent consideration of the problem has rather suggested that the shooting area is too limited. The present arrangement is such that the game fence follows the very edge of the high tsetse density area, better termed the "parent population" area. The shooting has therefore only been directed against the "fringe population" or what could be called the "overflow population" and it would seem that even if it were possible to achieve complete eradication of game between the fences as these stand at present the "fringe or overflow population" would still continue to exist. On the other hand, however, had the shooting been carried out so as to include the areas of high tsetse density, that is to say, had the entire habitat been attacked, then it is probable that with game eradication of an order similar to that already obtained between the fences the tsetse population would by now have been appreciably reduced. Western Urungwe is an excellent example of an area in which control has been achieved by attacking the game throughout the entire habitat.

If the above assumption is correct, what should now be the approach in Sebungwe? For game destruction to succeed, the area must be extended. This, though, is against the policy of the department and since a new method is available in the form of discriminative spraying with residual insecticides it has been decided to abandon the present operations without delay. The control of big game animal movement will however continue, using the game fence as the deterrent.

In concluding, it is probably true to say that the hunting operations must have held the tsetse to some extent from further advance.

2. *Game Movement Control Operations*

It is believed that big game movement, especially that of elephant, has been contributary to the westerly advance of *G. morsitans* in the area to the south-west of Kariangwe; this advance is mentioned in both the 1957-58 and 1958-59 reports.

In order to control this movement a game fence 17 miles long was erected during August and September from a point on the existing game fence about four miles east of the western end, north-eastwards, northwards and north-westwards across the Manyende, Mabobola and Siazundu Rivers to the edge of the Zambezi Escarpment. A respect for the fence by the larger game animals, other than elephant, is to be achieved by shooting those animals which are actually found on the immediate fence line. Fence patrol guards will therefore be armed.

Elephant are rather a separate problem in that the herds move extensively between the Mlibizi area of the Zambezi Valley and the Maseme and middle Nagupande River systems along both the Mlibizi and Siazundu Rivers. Discussions with the Director of Wild Life Conservation have however resulted in a plan to drive the majority of the elephant from within the Mlibizi area of the Zambezi Valley, by selective shooting over a period, eastwards through the game fence and into the very extensive unoccupied areas lying to the east. Several wide gaps, with slight funnelling towards the east, have been left in the fence in order to facilitate this drive. The operation will be carried out chiefly by officers of the Departments of Wild Life Conservation and National Parks, though whenever possible officers of the Native Affairs Department and this Department will also help.

3. *The Maseme Residual Insecticide Spraying Operation*

In order that positive action could be instituted to halt the westerly advance of *G. morsitans* in the area to the south-west of Kariangwe mentioned above it was decided to carry out a large-scale insecticide operation over that area above the Zambezi Escarpment which is drained by the headwaters of the Maseme, Dett, Chicomba and Siazundu Rivers and by the Munde and Mabobola Rivers. It was held that if the high-density population in this area could be reduced rapidly to a low level then the position would be secured. The operation was carried out on an experimental basis so that maximum information on the method could be obtained.

Preparations for the operation involved the production of a 1 : 40,000 map from aerial photographs showing all drainage lines and potential *G. morsitans* dry season habitat, the development of some 41 miles of road, the laying out of 17 fly-rounds and investigations on resting behaviour of this species. Before preparations for the operation began there were already four "foot" fly-rounds and one "bicycle" fly-round in operation within the area. These, together with the 17 mentioned above, made 22 fly-rounds in all. On 12 of the 17 new rounds oxen were used as bait animals; the remaining five were "bicycle" rounds. Control data were supplied by four "foot" fly-rounds and three "bicycle" fly-rounds in the Lusulu area (some 30 miles east of the operations area) and from Control I of the shooting operations area fly-round system (some 15 miles to the south-east).

The actual operation was carried out during the period 19th August to 16th September, 1960. Spraying was discriminative, being based on the knowledge that *G. morsitans* concentrates during the late dry season in specific vegetation types; these include the associates of the vlei edges, the major drainage lines and rock outcrops. The estimated area actually treated was in the order of 5 per cent. of the total area covered (108 square miles), that is the area drained by the river systems described above. Several small areas were set aside within the operations area for various experimental treatments (Map No. 2).

Ten Schefenacker and one Fontan motor-powered, low-volume, mist sprayers were available for the operation. It was thus possible always to have ten machines in the field and one in reserve. The insecticide used was an emulsion containing 3.72 per cent. dieldrin obtained by diluting Shell Dieldrex "15" (18.6 per cent. dieldrin) with river water in the proportion of 1 : 4. A total of 5,235 gallons of the insecticide emulsion was applied to potential resting sites of *G. morsitans* over 813 miles (cyclometer measured) in 617 machine hours. The application rate was therefore 6.45 gallons per mile or 7 gallons per hour.

The cost of the operation, including the preparatory work, on the basis of insecticide used, machine running costs, labour, transport and some miscellaneous items was £5,125. If the figure of 108 square miles is taken as the total area treated the cost works out at £47 10s. per square mile or 1s. 6d. per acre.

Eight weeks after completion of spraying the tsetse population density had fallen by about 98 per cent., with the expectation of further decrease as the dry season progresses. It would seem that control over the westerly advance has been achieved.

It can also be concluded from this operation that the department now has a method of control with which to replace game destruction, as is indicated under "Hunting Operations" above.

A detailed report on the operation is being prepared for publication separately.

4. *Aerial Smoking Campaign (1957): Lubu Valley*

The Lubu Valley fly-rounds have been carried out regularly throughout the year and the figures from these indicate that the suggestion in last year's report of a rapidly recovering tsetse population was premature. The population remains at a low level.

It is gratifying to note that the density of African settlement is on the increase.

5. *Traffic Control*

Six traffic control points operated throughout the year within the area, namely Natulwe Gate, Siambola Gate, Lubimbi Gate, Mzola Gate, Sefula Gate and Gokwe Gate.

There was a very considerable increase in the catch at Siambola Gate during August when 959 *G. morsitans* were taken. This is the highest total ever recorded for the control point. Cyclists carried 724 of these tsetse. Natulwe and Gokwe Gates both yielded tsetse flies during the year: Ten *G. morsitans* were taken off westbound traffic at the former and 15 *G. morsitans* were taken off southbound traffic at the latter. Once again a Swingfog machine was used at Mzola Gate on all southbound motor vehicle traffic.

6. *Cattle Control Fence*

The cattle fence was maintained efficiently throughout the year. Game animals caused a few breaks. Drought relief cattle based on the Karna Block Ranch broke through the fence on two occasions in the vicinity of the Dongamusi River, into the area of tsetse control operations.

7. *Survey and Tsetse Distribution*

Survey work other than that for the Maseme Insecticide Operation was restricted to the general mapping of the western half of the shooting operations area and the preparation of a detailed vegetation map of the Lusulu Veterinary Experimental Ranch area. Mr. R. D. Pilson carried out all this work.

The routine fly-rounds at Lusulu have revealed the presence of *G. pallidipes*. One male and one female have been taken to date. A previous record of this species was made at Lusulu camp by Mr. Gillett in December, 1957. It was thought at the time that this specimen had probably been carried from the Sitonka's area which lies to the north of Lusulu, but it is now obvious that it originated locally. The vegetation map shows an extensive area of likely *G. pallidipes* habitat and with the introduction of bait oxen in the very near future as is planned, the true position should be revealed.

8. *Investigational Work*

Investigational work carried out in the Sebungwe area during the year included a marking experiment to detect movement of tsetse fly and studies of resting behaviour and diurnal feeding activity of *G. morsitans*. This work is dealt with in the Research and Investigation Section of this report.

9. *Blood-meal Collections*

One blood-meal collection was made in conjunction with the marking experiment carried out in the headwaters of the Nagupande and Dongamusi Rivers area. The results of this are given by Mr. Pilson in the investigational section of this report.

The second blood-meal collection was made in the Maseme spraying operations area prior to the spraying.

It is of interest to note that 6 per cent. of the feeds were from birds.

10. *Puparia Collecting*

In the Gwababa area 7,815 puparia were collected in October, 1959; this was a mixed collection of *G. morsitans* and *G. pallidipes* puparia. The pupal searchers were moved back to Kariangwe at the end of October, 1959; and from then until the end of August, 1960, they worked over the Chicomba River headwaters area. During this period they collected 10,051 *G. morsitans* puparia. All puparia collected have been forwarded to Salisbury for distribution between Dr. Barrass and Dr. Bursell of the University College of Rhodesia and Nyasaland and the headquarters laboratory. The puparia collecting was suspended at the end of August, 1960, when the area was treated with insecticides.

11. *Collecting of Blood Serum*

A quantity of duiker blood serum was collected during August, 1960, for Mr. B. Weitz of the Lister Institute of Preventive Medicine, Elstree, England, for use in the identification of blood-meals.

12. *Kariba Resettlement Areas: Binga District*

The Assistant Director of Veterinary Services (Field) and the Entomologist, Zambezi Belt, accompanied a group of officials from the Department of Native Affairs and Native Agriculture and Lands, together with a member of the Natural Resources Board on a tour of the Kariba resettlement areas in the Binga district during July, 1960. The object of the tour was to study and discuss the future of Batonka River bank cultivation as related to soil conservation ideals and anti-tsetse measures. It was pointed out that the clearing of river banks for cultivation was a most useful contribution to tsetse reclamation and as a result it was generally agreed that this age-old custom should continue, providing that in situations where erosion was likely to occur, control measures could be instituted. The need for the closest collaboration between the departments represented was frequently stressed.

13. *The Lusulu Trypanosomiasis Experimental Station and Ranch*

There has been the closest co-operation between the Veterinary Department and this department in the planning of the Lusulu Trypanosomiasis Experimental Station and Ranch. As mentioned above, a vegetation map of the Lusulu area has been prepared by the Survey Ecologist, and staff of this department are at present constructing additional living quarters and renovating existing out-buildings.

The Native Affairs Department are very kindly providing three boreholes for the ranch.

B. SANYATI (Gokwe Native District)

1. *Hunting Operations*

Hunting was suspended at the end of February, 1960, in order that the hunters could be used to construct the game fence — labour is difficult to obtain in this area — and these operations had not recommenced at the end of September. During the period of hunting, that is from 1st October, 1959, to 29th February, 1960, 1,389 animals were destroyed at an average of 7.2 animals per hunter per month. Ammunition expenditure was at the rate of 2.37 rounds per animal. Twelve elephant were also destroyed by the senior field officer.

The game fence was constructed during the period 1st March to 15th July, 1960. The fence runs along the eastern side of the Umvumvudsi River from the Sanyati to a point on the Copper Queen - Gokwe Road near Mtungi Pan; here it turns south-west and follows this road to the foot of Nyamaroro Hill, where it ends. The length of the fence is 52 miles. A feature of the fence is a clearing of 20 yards width on either side of it along its entire length; this was cut after the completion of the fence.

It had been planned to recommence hunting operations on 1st October. These were to be confined to the areas of known tsetse lying to the east of the fence, namely the area bounded by the fence, the Sanyati and the Hwonyi River and in the Mtungi Pan - Umvumvudzi headwaters area. However, with the very favourable results of the Maseme insecticide operation now available, together with the conclusions drawn about the use of shooting between marginal fences in Sebungwe, the Sanyati game destruction scheme is again being reviewed and is likely shortly to be abandoned in favour of defence by insecticides.

A number of new roads were opened up to facilitate hunter control.

2. *Survey and Tsetse Distribution*

The Umvumvudzi River system was mapped from 1 : 40,000 aerial photographs and a preliminary tsetse survey was carried out. *G. morsitans* occurs in medium to high density along the middle and lower Umvumvudzi River system and in very low density on the Umvumvudzi headwaters. Occasional captures were made during the year in the vicinity of the Nembudzia, the Umvumvudzi Road crossing and the Mtungi Pan, using bait oxen. *G. pallidipes* were found to occur in high density in the area of the Chorongo waterhole, which lies just to the west of the Umvumvudzi River. A single *G. pallidipes* was also taken at Nyagara waterhole on the Umvumvudzi. Surveys in the north and east of the area revealed *G. morsitans* in medium to low density on the Yanse and Hwonyi Rivers and in the vicinity of Ganderowe but no tsetse were found on the Nyangadza and Mongolowe Rivers. *G. pallidipes* was taken on the Yanse River. Bait oxen surveys made on the Ungwe and Marowa River headwaters gave negative results.

C. URUNGWE (Urungwe and Kariba Native Districts)

1. *Hunting Operations*

(i) *Urungwe West.* Hunting has continued in the area bounded by the Urungwe Native Reserve on the east, the Sanyati on the west and Zambezi Escarpment in the north and the Fluechi River in the south. 1,101 game animals were destroyed during the year at an average of 2.44 animals per hunter per month. Ammunition expenditure was at the rate of 3.48 rounds per animal.

It is pleasing to note the very considerable degree of control achieved over the tsetse population in this area by hunting operations. The improvement is best illustrated by the Chiroti Gate records. During the year 1954/55, 1,186 *G. morsitans* were taken from eastbound traffic as compared with nine taken this year. Patrols carried out throughout the area have also continued to demonstrate the improvement.

(ii) *Urungwe North and East.* The North and East Urungwe areas have been operated as one area during the past year under a field officer stationed at Kariba. The game fence was maintained efficiently throughout the year. Elephant caused damage to the fence from time to time, especially in the Charara area. Animals destroyed during the year totalled 1,385, at an average of 4.38 animals per hunter per month. Ammunition expenditure was at the rate of 2.59 rounds per animal. The field officer destroyed three elephant. There was no hunting to the east of the eastern end of the game fence.

2. *Road Development*

Funds were made available during the year to develop tracks for regular bicycle fly-round patrols along the Tsororo, Charara, Rueisi, Rekomitjie, Chitaki, Chewore and Mauoro Rivers.

3. *Traffic Control*

There were four traffic control points in operation throughout the year, namely Chiroti, Manyangau, Makuti and Chirundu. The Vuti Chamber was moved to Makuti in December, 1959. *G. pallidipes* were taken at Manyangau, Makuti and Chirundu.

4. *Survey and Tsetse Distribution*

It was reported in January, 1960, that tsetse were numerous on the Charara River some three miles west of Ambakwe Hill. Investigations made however only revealed *G. morsitans* in very low density. It would appear, though, that there has been some extension of this species up the Charara River valley.

5. *Rekomitjie Field Research Station*

Work carried out here included the operation of routine fly-rounds; the dissection of 4,665 individual *Glossina* during infection rate studies; the collection of wild trypanosome strains; the examination of blood and gland smears from animals shot, and studies on the diurnal feeding activity and resting behaviour of *G. pallidipes*. Certain of these items are dealt with by Miss B. M. Leggate in section 3 of this report.

(a) *Routine Fly-rounds*. The mean monthly catches during the last four months of the year on two fly-rounds—

(i) along a vegetation contact between mopane woodland and thicket, and

(ii) in riverine vegetation,

are given in Tables I and II. Perhaps the chief point brought out by these data is that the use of an ox as bait trebles the catch of *G. morsitans*. In part this is due to an increase in the percentage of females caught. Similar observations have already been made at Kariangwe. Hitherto, accepted practice has been to use only the catchers themselves in surveys for *G. morsitans*. Where the density of the tsetse is low, it is clearly advantageous to use a bait animal. An increase in the catch with a bait animal of the order of 2 to 300 times with *G. pallidipes* is, of course, well known. The figures also show the increase in density in riverine thicket in relation to the catch in the mopane thicket contact as the weather gets hotter (34.3 to 3.2 in June and 16 to 15.9 in September). This tendency of *G. morsitans* to concentrate along rivers in the hot weather is an aspect of its behaviour of which advantage is taken in the discriminative spraying of insecticides.

(b) *Trypanosome Strains*. Three strains of *brucei* type trypanosome have been obtained by inoculation of gland material from dissected *Glossina* into rats. One of these has been sent to Dr. H. Fairbairn at Cape Town. It is intended to hold a collection of trypanosome in deep freeze in the Veterinary Research Laboratory in Salisbury.

(c) *Infection of Game Animals*. During the year the blood of five impala, three wart-hog, one buffalo, six kudu, two duiker and one bushbuck was examined for trypanosomes: 30 ccs. of blood of each animal was spun on a hand centrifuge. Only two animals were found infected, *T. congolense* appearing in the leucocyte layer of the blood from one male and one female kudu, both being immature animals.

6. *Camp Construction*

Three rondavel-type buildings for European accommodation, a number of African houses, an additional laboratory and a large store were built at Rekomitjie. A three-bedroomed house was built at Kariba for field officer accommodation. A new office block and African housing have been built at Makuti. A successful borehole was sunk at Rekomitjie and the water supply is now ensured.

7. *Urungwe Trypanosomiasis Committee*

The Senior Entomologist and the Entomologist, Zambezi Belt, attended two meetings of the Urungwe Trypanosomiasis Committee during the year.

D. NORTH LOMAGUNDI (Lomagundi and Sipolilo Native Districts)

Once again no cases of trypanosomiasis occurred within the Doma area and no tsetse were caught or seen above the escarpment. In view of this continued most satisfactory position hunting operations were terminated at the end of May. Since then considerable efforts have been made to develop the system of roads within the Zambezi Valley still further in order to facilitate survey and the planning of a defence system based on the use of insecticides. The department now maintains 191 miles of roads in this very difficult country between the Angwa and Hunyani Rivers below the Zambezi Escarpment.

E. ACKNOWLEDGEMENTS

It is with pleasure that I acknowledge the co-operation which has been extended at all times by officials of the Departments of Veterinary Services, Native Affairs, Wild Life Conservation and National Parks in dealing with mutual and other problems.

I must record with considerable thanks the loyalty and enthusiastic efforts of all the staff, both European and African, throughout the Zambezi area.

FLY-ROUNDS, REKOMITJIE — MEAN CATCHES

TABLE I
G. MORSITANS

Month	Vegetation Type	With Ox						Without Ox					
		NT		T	Total	T%	F%	NT		T	Total	T%	F%
		M	F					M	F				
June	(i)	24·1	5·7	4·5	34·3	13·1	19·1	10·0	0·6	0·7	11·4	6·6	5·7
	(ii)	2·1	0·9	0·2	3·2	6·2	30·0	0·2	0·0	0·0	0·2	0·0	0·0
July	(i)	19·7	3·0	6·0	28·7	20·9	15·2	10·2	0·2	1·2	11·6	1·0	1·9
	(ii)	1·0	0·4	0·3	1·7	17·6	18·6	0·6	0·0	0·0	0·6	0·0	0·0
August	(i)	24·0	2·0	1·0	27·0	3·7	7·7	5·8	0·6	0·0	6·4	0·0	9·4
	(ii)	10·0	2·2	1·2	13·4	8·9	18·0	1·7	0·0	0·0	1·7	0·0	0·0
September	(i)	13·2	1·0	1·8	16·0	11·2	7·0	5·2	0·0	0·3	5·5	5·2	0·0
	(ii)	12·1	1·8	2·0	15·9	12·5	12·9	5·5	0·7	0·2	6·3	3·2	11·3

TABLE II
G. PALLIDIPES

Month	Vegetation Type	With Ox						Without Ox					
		NT		T	Total	T%	F%	NT		T	Total	T%	F%
		M	F					M	F				
June	(i)	4·0	8·0	2·3	14·2	15·5	66·7	0·0	0·2	0·2	0·3	66·0	100·0
	(ii)	33·1	52·4	20·4	105·9	19·2	61·3	0·2	0·0	0·3	0·5	60·0	0·0
July	(i)	2·7	6·0	1·3	10·0	13·0	69·0	0·0	0·0	0·0	0·0	0·0	0·0
	(ii)	34·4	27·2	9·4	71·1	13·2	44·1	0·0	0·0	0·0	0·0	0·0	0·0
August	(i)	0·0	10·5	0·0	10·5	0·0	100·0	0·0	0·0	0·0	0·0	0·0	0·0
	(ii)	15·4	19·0	4·2	38·6	10·9	55·2	0·0	0·0	0·0	0·0	0·0	0·0
September	(i)	1·0	2·0	0·8	3·8	21·0	66·7	0·0	0·0	0·0	0·0	0·0	0·0
	(ii)	4·1	6·1	3·5	13·8	26·4	59·8	0·2	0·2	0·2	0·5	50·0	50·0

(2) THE SABI - LUNDI TSETSE FLY FRONT

by R. GOODIER, *Entomologist*

INTRODUCTION

This year has seen major progress in the development of the extensive scheme for the control of tsetse in the south-eastern fly-belt. This scheme is based on the utilization of the comparatively open basalt areas as a natural barrier against tsetse advance and the supplementing of it by various operations designed firstly to eliminate tsetse in those areas where they have already commenced to penetrate the weak points in the barrier and secondly to reinforce the barrier by bush-clearing operations in those places where it is pierced by river systems with vegetations suitable for tsetse.

The major setback of the year has been the great increase of trypanosomiasis on Humani and Devuli Ranches in the northern part of the Sabi tsetse belt.

This year has seen the end of the use of game destruction as a means of combating tsetse in the south-eastern fly-belt and its replacement by other methods of control including bush clearing and the application of insecticides.

THE SABI EAST TSETSE CONTROL AREA

Towards the end of 1959 it became apparent that the game destruction campaign in the Makossa Hills to the east of the Sabi River was not having the desired effect. The catches on fly-rounds in the area indicated that although the campaign had reduced the tsetse population and caused changes in its structure, it was not going to prove possible to eliminate tsetse in the area by game destruction. After much consideration, it was decided to cease the game destruction campaign at the end of January, 1960, and to redesign the tsetse control operations to the east of the Sabi so as to bring them into line with the methods adopted on the west of the Sabi. As the Sabi West game destruction operations had been terminated at the end of February, 1959, this meant that no more game destruction would thenceforward be used as a means of controlling tsetse in the south-eastern fly-belt.

As it was envisaged that the game in the Makossa area would increase following the cessation of hunting and it was thought undesirable to have game moving northwards into tsetse-free areas it was decided to build an east-west game fence between the eastern border fence at Makaro and the Msaswe-Sabi fence. This Makaro-Msaswe fence was constructed from materials already in hand between February and April, 1960. The total cost of constructing the nine miles of fence was £346, the cost per mile being £38 to £39, excluding materials. At the same time it was decided to consolidate the position along the fence line on the southern edge of the basalt zone by carrying out the clearing of ridges carrying thicket and small patches of *Brachystegia tamarindoides* woodland just to the north of the fence. This work was designed to be complementary to the Honde-Rupembi watershed clearing which were completed in 1959. Between May and September, 1960, 315 acres had been cleared (sheer-felled and ring-barked) by hand labour at a total cost of £355, the cost per acre being 22s. 6d. Several *G. morsitans* were caught during the course of the clearing operations.

The situation in the basalt zone to the north of the Makossa Hills now appears to be fairly stable. Very little trypanosomiasis occurs in the cattle dipping at Chisumbanje in spite of the fact that some graze to within four miles north of Hippo Mine.

The serious trypanosomiasis situation to the north of the basalt zone on the east of the Sabi River had, to some extent, been elucidated this year after much survey work. Some indication of the laborious nature of survey work in this area is given by the fact that about 750 patrols with bait cattle were carried out in the areas of endemic trypanosomiasis before tsetse, both *G. morsitans* and *G. pallidipes,* were located close to cattle grazing grounds in the Lusongo area near to the Moçambique border. Further intensive bait cattle patrols eventually revealed, in July and August, 1960, the presence of *G. pallidipes* in woodland about three miles south of the Mwangazi Gap, one of the most seriously infected areas. This survey work, together with the vegetation mapping which has been completed this year by Mr. Farrell, will be the basis of future control measures.

THE SABI WEST TSETSE CONTROL AREA

(a) *The Chiredzi - Lundi Section.* The Chiredzi - Lundi clearing scheme which was commenced in August, 1959, to prevent the advance of tsetse through the basalt zone up the Lundi and Chiredzi Rivers has continued throughout the year. Both bulldozers and hand labour have been employed, the latter for removing the river bank vegetation where the use of bulldozers would have caused erosion. The mechanical clearing was completed in September, 1960, approximately £27,000 having been spent on clearing 3,450 acres of woodland, an average cost per acre of £7 17s. The hand clearing has proved very slow work, due to the necessity of stumping and will be continued during the coming year. Between October, 1959, and September, 1960, the hand labour cleared 300 acres of heavy riverine vegetation at a cost of £3,549, the average cost per acre being £11 16s.

The combined effect of the insecticide campaign in September, 1959 (described in last year's report), and the bush clearing has been the complete absence of cases of trypanosomiasis on Lone Star Ranch since September, 1959. This contrasts with 68 cases in European- and African-owned cattle on Lone Star Ranch during the previous year.

(b) The Mkwasine Section. In order to complete the mechanical bush clearing on the Mkwasine system which had been commenced in the first half of 1959 the bulldozer team returned to the area and cleared some 700 acres of riverine vegetation near the mouth of the Mkwasine and a further 300 acres of *Acacia* spp. woodland in the southern part of the Sangwe African Reserve. Apart from a certain amount of hand clearing to tidy up the river banks the clearing has now been completed in this area.

(c) *The Humani and Devuli Ranch Area.* The area of Humani and Devuli Ranches has been the scene of the most serious developments in the trypanosomiasis situation during the year under review. Trypanosomiasis has occurred sporadically on Humani Ranch and on the Masapas section of Devuli Ranch for some years past but this year has seen an intensification to epidemic proportions in that area of Humani Ranch close to the Turgwe River and an extension of the infection northwards into the "A" section of Devuli Ranch. Intensive patrol work and pupal searching during the year has failed to reveal the presence of tsetse but the trypanosomiasis situation was such that the presence of a tsetse infestation, probably of *G. pallidipes,* had to be assumed. While investigations were being carried out and vegetation maps of the area were being prepared the cattle in the infected areas were maintained under drug treatment. In view of the seriousness of the situation and the need for rapid results it was decided to undertake an insecticide operation of the same kind as had been carried out on the Chiredzi system last year (Map No. 3).*

The spraying campaign was commenced on August 15th and completed in 26 working days by September 15th. During this time approximately 6,225 gallons of 3.6 per cent. dieldrin were applied to approximately 13,700 acres of presumed tsetse habitat on Humani and Devuli Ranches. An average of 0.45 gallons of the emulsion were applied per acre. The costs of the operation amounted to £4,100 giving an average cost per acre of about 6s. Following the insecticide campaign the cattle in the infected areas were block inoculated so as to clear them of trypanosomiasis in order to assess the results of the spraying campaign which should be evident in the trypanosomiasis figures for October, 1960, onwards.

THE SOUTH LUNDI TSETSE CONTROL AREA

This year has seen good progress in the development of anti-tsetse measures in the area to the south of the Lundi River. A Field Officer was stationed in the area in December, 1959. Survey work with bait cattle was commenced at the beginning of 1960 and a survey of the vegetation of the area was completed by Mr. Farrell in July, 1960.

The basic problems in the area to the south of the Lundi are firstly to prevent the south-westwards spread of the *G. morsitans* belt towards the Nuanetsi and Limpopo drainage, and secondly to prevent the spread of tsetse westwards into

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*It is of interest to compare the pattern of the two spraying operations, in the *Brachystegia* woodland of the Maseme Basin in the Zambezi Valley and in the riverine forest and woodland of the Turgwe and Sabi Rivers. In the former, in country with a mean annual rainfall of 25 to 30 inches the *morsitans* habitat is dispersed throughout a number of individually small vegetation communities; in the latter, with a mean annual rainfall of about 16 inches, the habitat, presumably of *G. pallidipes* is compact and continuous.

the Matibi No. 2 African Reserve and up the south bank of the Lundi River. The westward advance of tsetse into the Matibi No. 2 Reserve is hindered to a large extent by the development of African agriculture in the reserve and by the fact that much of the reserve is black basalt country unfavourable for tsetse. There was, however, contact between native cattle and *G. morsitans* along the Tchingwedzi River, the eastern boundary of the Reserve. To reduce this contact a bush-clearing scheme was initiated in July, 1960. By the end of September approximately 555 acres of riverine vegetation along the Tchingwedzi River had been felled by hand labour at an average cost per acre of 21s. 2d.

The prevention of the south-westwards expansion of the tsetse belt is a much larger problem. On the basis of the survey work undertaken during the year under review it has been decided that the expansion of the tsetse belt in a south-westerly direction can best be prevented by clearing all the potential *G. morsitans* habitat in a strip 10 miles wide along the north side of the railway line from the edge of the basalt zone in the Matibi No. 2 African Reserve to the Moçambique border at Malvernia. This will mainly involve the clearing of areas of *Julbernardia globiflora* and *Androstachys johnsoni* woodland. A bulldozer team will commence work in the area in October, 1960.

SURVEYS, ETC.

As well as survey work directly related to the control and reclamation projects described above other smaller surveys have been made during the course of the year to elucidate the tsetse position in certain important localities, particularly on the forward edge of the black basalt zone. Frequent bait cattle patrols have revealed that *G. morsitans* is still present in small numbers in the immediate vicinity of Chipinda Pools as was suspected from the incidence of trypanosomiasis in cattle held there by this department. Similar patrols along the southern edge of the basalt zone to the east of the Sabi have revealed the continuing presence of both *G. morsitans* and *G. pallidipes*.

Investigations into the species composition and seasonal incidence of haematophagous diptera other than tsetse have been carried out at the main camp at Chipinda Pools and are reported on elsewhere.

GENERAL

Three houses have been constructed this year at Chipinda Pools for the resident Entomologist and field officers and new compound buildings for African staff are almost complete.

The Entomologist and senior field officer have attended quarterly meetings of the Fort Victoria District Trypanosomiasis Committee throughout the year.

(3) OTHER AREAS

by DR. G. F. COCKBILL, *Senior Entomologist*

CHIPINGA

The main task continues to be the slashing of regenerating bush on the Border Clearing. This work is now confined to a zone one mile deep from the international border. The work does not get lighter and attempts to discover improved techniques are not, so far, very promising, though it is evident that much could be achieved by greatly increasing expenditure for intensive treatment of certain species. Thus, on Wolverhampton, stumping of regenerating guava achieved a 60 per cent. kill. A trial of the effect of continued slashing over 12 months of new foliage from the very densely sprouting stumps of *Brachystegia* on Lettie Swan was a complete failure. Probably the only satisfactory treatment in many of the vegetation communities would be stumping followed by cultivation over several seasons. Where the continuous slashing has stimulated growth of roots and underground stems, such treatment would be extremely expensive.

Further observations were made on the effects of chemical brush killer on the species of trees encountered most frequently in the annual bush-clearing operations on the Border Clearing, and a further series of experiments was undertaken. The results to date are presented elsewhere in this report.

The incidence of trypanosomiasis on European-owned farms showed little change. A total of 56 cases were recorded from 11 farms, compared with 52 cases from the same number of farms last year. Both *T. congolense* and *T. vivax* were present, but the only cases of *T. vivax* occurred on those farms associated with the lower Umseleswe drainage system. This association was commented upon more fully in the Annual Report for 1958 - 59, pp. 206 - 208.

The species *G. brevipalpis, G. pallidipes, G. morsitans* and *G. austeni* were recorded from patrols in the Busi and Inyamadzi Valleys, using bait pig, bait oxen, fly-boys and traps as attractants.

MTOKO

Only one case of trypanosomiasis, involving *T. congolense,* was recorded within the Mtoko Reserve at Katsande. Over 60 cases occurred in Chikwizo Reserve, but the position is kept under control by the use of trypanocidal drugs. The recrudescence of the disease in those animals not subjected to drug treatment indicated that there is, in this area, a constant threat of trypanosomiasis.

Defence against incursion of *G. morsitans* in Mtoko District depends in part upon comparatively dense settlement in Special Area A (Mkota) between the Mtoko - Tete Road and the Mazoe River and in Special Area B (Chikwizo) on the north bank of the Ruenya River. Unfortunately, between these two areas lie the uninhabited valley of the Mudzi and Nyamsandsara Rivers and the Umtsinga Native Purchase Area. The latter is dominated by the hill Karere, lying athwart the Moçambique border. *G. morsitans* can always be caught here, while the two rivers mentioned provide paths along which tsetse move into Southern Rhodesia where they may be occasionally taken as far as 20 miles from the border. The chief anti-tsetse measure in these unsettled areas continues to be game destruction. The Second Report of the Select Committee on Resettlement of Natives presented to the Southern Rhodesian Legislative Assembly in August offers the hope that a more logical and certainly more productive and less destructive system of trypanosomiasis control will eventually be possible in the district. Organized African settlement in the Mudzi Valley, plus a certain amount of bush clearing along the border fence line, should permit the pasturing of cattle up to at most a mile from the international border at very little cost in drugs and insecticides.

Among the animals shot during the year duiker, baboon, kudu and grysbok accounted for 79 per cent. of the total of 1,899 killed. As in the much larger Sebungwe area (*q.v.*) it was evident that much higher kills could be obtained by changing techniques. Thus during April the field officer in charge noted an increase in tsetse caught between the Mudzi and Nyansansara Rivers and concentrated his hunter force here for five days. At the beginning of the period a game drive was organized to flush animals from cover and 50 were killed, a marked contrast with the results of normal shooting during the rest of the month, which accounted for only 90 animals. There has been no hunting of elephant during the year and these animals have caused a good deal of damage to fences. It is probable than an elephant control programme will be required before long.

Traffic control points were operated in three places. Eighty *G. morsitans* were taken at the Border Gate on the Tete Road, but only one at the Suskwe Chamber on the same road where it leaves the tsetse defence area. Twenty tsetse flies were taken at the Makaha Gate.

INYANGA NORTH

Trypanosomiasis in cattle kraaled near the Ruenya River in the north of this district within 20 miles of the international border had been controlled satisfactorily by bi-monthly treatment with antrycide dimethyl sulphate. No *Glossina* have been reported except that in 1958 a single *G. morsitans* was captured by a departmental employee returning from leave. There have, however, been no regular patrols.

In January, 1960, at Fombe there were several break-throughs of infection only 28 days after antrycide treatment. After sanative treatment with berenil, prophylaxis with Antrycide Prosalt R.F. was instituted. In March, 20 days after inoculation by this latter drug, 24 cattle were again positive and there could now be little doubt that local trypanosomes had become resistant to antrycide. In May a regime of inoculation with metamidium was started and since then the position has remained satisfactory.

The appearance of drug-fast strains suggests that the trypanosome risk in the Ruenya Valley is much higher than the seemingly very low density of *G. morsitans* would indicate. Clearly, there is a need for entomological survey in the area to provide a basis for extending the Mtoko operations area southward to include the Inyanga North Native Reserve.

As a first step a field officer has been sent to the Ruenya Valley to construct a new field station. This has been sited on the north bank of the Ruenya River, in Mtoko District. Here it can be reached from Salisbury in half-a-day at all seasons whereas the approach through Inyanga takes two days in good weather and is completely barred in bad. During the rains a boat can be used to ferry across the Ruenya while, for dry weather access, the Native Department have very kindly repaired an old causeway.

III. INVESTIGATION AND RESEARCH

(1) ARBORICIDE EXPERIMENTS

by G. F. Cockbill

Reference was made in the Annual Report for the year ended 30th September, 1959, to the initiation of experiments using arboricide as a means of controlling regrowth on the Chipinga Border Clearing. Mixtures containing 3 per cent. and 6 per cent. active ingredient of the butyl esters of 2,4-D and 2,4,5-T in lighting paraffin (kerosene) were applied to those species of woody plants most frequently encountered in bush control work on the Border Clearing. Treatments were applied to individual plants of 46 species during January, February, March and April, 1959. It was thought that differences attributable to the physiological condition of the plants might be revealed by treating the same species at intervals throughout the growing season.

The effect of these treatments was assessed periodically to the end of September, 1960. It has at times been difficult to declare a plant dead with any certainty under the conditions of this experiment. Regrowth has been cut back annually for over 25 years, and the underground portions of the stumps extend over a wide area. Cases have occurred where the treated aerial parts of a plant have apparently died, but, several months later, regeneration has occurred some distance away, issuing from an underground root system. The following results should be regarded with this note of caution in mind. Some species were resistant to treatment with both 3 per cent. and 6 per cent. mixtures, such as:

	ChiNdau Name
Afrormosia angolensis	Chiyanga
Annona senegalensis	Muyembe
Antidesma venosum	Murongamunyu
Bauhinia punctata	Chigwendere
Brachystegia spiciformis	Mutsatsa
Brackenridgia zanguebarica	Muminu
Burkea africana	Mukarati
Combretum molle	Mukomahamba
Diplorhyncus condylocarpon	Mutowa
Ficus gnaphalocarpa	Muwonde
Hymenocardia acida	Chiswati
Maytenus cymosa	Chihlangwa
Parinari curatellifolia	Muchakata
Peltophorum africanum	Muzeze
Psidium guajava	Guava
Psorospermum febrifugum	Mutswatswa
Pterocarpus angolensis	Mukwa
Pterocarpus rotundifolius	Mbhungu
Sclerocarya caffra	Mugano
Strychnos spinosa	Mutamba
Terminalia brachystemma	Mususu

Some were apprently killed by either treatment:

	ChiNdau Name
Lantana camara	(Lantana)
Lippia javanica	Mushani
Solanum aculeastrum	(Bitter apple)
Toddalia asiatica	Gato
Triumfetta sp.	Zunzu
Vangueria esculenta	Mugaromondoro
Vernonia ampla	Penembe

The buffalo bean, *Mucuna coriacea,* was killed at each application of the 3 per cent. mixture but some of the plants treated with 6 per cent. mixture regenerated about 12 months after treatment. It is of some practical importance to have a means of killing the buffalo bean. This plant with its urticating hairs, and *Toddalia asiatica,* with its sharp thorns, make clearing operations difficult and painful for labourers during the dry season. *Lantana camara,* which occupies considerable areas in the native areas adjacent to the Border Clearing appeared to be very susceptible to either treatment.

Arboricides may have some application in clearing operations involving mature, uncut trees. Growing trees were felled in January, 1959, at about three feet from the ground, and a 6 per cent. mixture in lighting paraffin was applied to the cut surface. This experiment was repeated in February, March and April. A similar series of trees was treated by "frilling" the bark with deep, oblique incisions reaching to the sapwood and applying a 6 per cent. mixture of arboricide in kerosene. This experiment was begun in February, 1959, and repeated in March and April. As a practical measure, frilling with treatment would be preferable to felling with treatment since far less labour is involved. In most cases, frilling with treatment was more effective than felling and treatment, but either treatment was generally more effective than treatment on the foliage. In the case of *Afrormosia angolensis, Antidesma venosum, Hymenocardia acida* and *Lannea discolor* frilling and treatment gave apparently 100 per cent. kill. Felling and treatment gave apparently 100 per cent. kill in the case of *Brachystegia* sp. (Pahla) *Burkea africana* and *Pygeum africanum* (Mparadza).

There appeared to be no real difference in effect due to time of spraying the foliage with 3 per cent. mixture, but the February application of the 6 per cent. mixture appeared less effective than those in the other months. Felling and treatment was most effective in February and least effective in April, while frilling and treatment was most effective in March and least in April.

When the April, 1960, assessment was made, 12 to 15 months after treatment, those trees showing signs of regeneration were given a second treatment similar to the first. The effects of this treatment were assessed six months later. Few species appeared to survive this second application. *Brachystegia spiciformis, Combretum molle, Crossopteryx febrifuga, Parinari curatellifolia* and *Pterocarpus rotundifolius* withstood both applications but the second application to the felled trees apparently killed *Afrormosia angolensis, Annona senegalensis, Antidesma venosum, Brackenridgia zanguebarica, Diplorhyncus condylocarpon, Markhamia acuminata, Milletia usuramensis, Piliostigma thonningii* (Musekesa), *Terminalia brachystemma, Uapaca kirkiana* (Mhlange) and *Vitex payos* (Mkubvhu).

The second frilling and treatment apparently killed *Annona senegalensis, Brachylaena* sp., *Brackenridgia zanbuebarica, Dombeya rotundifolia* (Mpundururu), *Markhamia acuminata* (Mpfeya), *Pterocarpus angolensis, Strychnos spinosa* and *Uapaca kirkiana.*

It would seem that frilling and the application of a mixture of the butyl esters of 2, 4-D and 2, 4, 5-T to give 3 per cent. of each active ingredient, followed, where necessary by a second application is a practical means of removing a portion of the unwanted vegetation in the Border Clearing area.

It was found that single species had attained dominance in certain areas along the Border Clearing. Thus *Lantana camara, Brachystegia spiciformis, Pygeum africanum, Uapaca kirkiana, Vangueria esculenta* and *Vernonia ampla* (Penembe) may form almost pure stands. Blocks of these species were treated with brush killer, using the knowledge obtained from the foregoing experiments. Where brush killer in oil had given a good kill, a 3 per cent. and 6 per cent. mixture in water was tried in the interests of economy. *Brachystegia spiciformis* gave very little response to brush killer in oil, in water, applied to foliage or applied to the cut stumps.

A 6 per cent. mixture in water gave satisfactory kills when applied to the cut stumps of *Lantana camara,* to the foliage and stumps of *Pygeum africanum* and to the foliage of *Vangueria esculenta.* Neither the 3 per cent. nor the 6 per cent. mixture in water was found to be effective on *Mucuna coriacea,* when applied to the foliage, on *Bauhinia punctata* when applied to the cut shoots, on *Lantana camara* or *Uapaca kirkiana* applied to the foliage.

A census was taken of all plants occupying the areas treated with the 3 per cent. and 6 per cent. mixtures in kerosene, at the time of the initial treatment and at subsequent assessments. On the 6 per cent. plots the reduction in total plants was 56 per cent. and on the 3 per cent. plots, 40 per cent. It became evident that if arboricides are to be used in bush-clearing operations, their use must be followed immediately by occupation and careful management of the reclaimed land. Although the total plants decreased in number the resistant species, particularly *Brachystegia spiciformis, Parinari curatellifolia* and *Royena sericea* readily occupied the cleared ground. Thus, on the 3 per cent. plots *B. brachystegia* increased

65 per cent., *B. curatellifolia* 58 per cent. and *R. sericea* 21 per cent. On the 6 per cent. plots the increases for these species were 28 per cent., 7 per cent. and 38 per cent. respectively.

(2) A COMPARISON OF TWO PERSISTENT INSECTICIDES

by G. F. Cockbill

Whenever persistent insecticides have been used in the control of bloodsucking insects the phenomenon of resistance has developed in all but a few species. As yet, resistance to persistent insecticides has not been encountered in *Glossina,* but the danger may be anticipated. It is frequently found that resistance in insects is closely related to the chemical composition of the insecticide and that cross-resistance develops to insecticides with similar chemical composition. Where resistance to an insecticide has been detected, it is the practice in control measures to make use of insecticides differing profoundly in structure from the original insecticide.

In control measures against tsetse in Southern Rhodesia involving the use of insecticides, use has been made of those based on chlorinated hydrocarbons, D.D.T., B.H.C. and dieldrin. In order to provide a further weapon against tsetse, and one which might be used in the event of the development of resistance to B.H.C., D.D.T. and dieldrin, preliminary tests were carried out, comparing the toxicity of Bayer S1752, an organo-phosphorus insecticide, with that of dieldrin in the form of Shell Dieldrex "15". The former insecticide is not yet available on the market, and its cost is unknown to us.

Filter papers were impregnated with watery suspensions of two insecticides, one based on dieldrin and the other on a phosphoric ester to give a deposit equivalent to 400 mgm. active ingredient per square metre. These filter papers were kept in 3 in. x 1 in. glass tubes fitted with corks. Unfed *G. morsitans* newly emerged from puparia in the laboratory were introduced to the tubes and kept in an incubator, in the dark at 25 ± 1° C. The tubes were inspected after one-, two- and three-hour exposures. The experiment was repeated as insects became available until 16 weeks after the application of insecticide.

Age of deposit	Percentage kill after —					
	1 hour		2 hours		3 hours	
	P	D	P	D	P	D
5–8 weeks	0	0	5	76	37	98
9–12 weeks	0	0	10	73	63	100
13–16 weeks	0	0	21	68	74	100

Table showing percentage kill of *G. morsitans* exposed to insecticides containing dieldrin (D) and phosphoric ester (P) at 400 mgm. per square metre.

The above table gives the results of this experiment. Figures are given as percentage kill (corrected by Abbott's formula)* at one-, two- and three-hour exposures, at 5-8, 9-12 and 13-16 weeks after initial application of insecticide.

It is apparent that 400 mgm. of dieldrin per square metre kills *Glossina morsitans;* that under the conditions of the experiment dieldrin retains its toxicity for at least 16 weeks after application; that the organo-phosphorus insecticide was toxic, but was slower in its action than dieldrin. It is of interest to note that the toxicity of the organo-phosphorus insecticide increased with increasing age.

Tests carried out with *Glossina morsitans* exposed to dieldrin on filter papers for different lengths of time indicated that 30 seconds exposure to 400 mgm. dieldrin per square metre gave 100 per cent. kills within 24 hours. Exposures of up to 480 seconds to filter papers containing 400 mgm. of the active ingredient of the phosphoric ester insecticide were found not to be lethal (compared with controls).

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*See Busvine, J. R. (1957). "A Critical Review of the Techniques for Testing Insecticides" —London, p.171.

(3) VEGETATION MAPPING—SABI AREA

by J. A. Farrell

During the current year, vegetation maps covering approximately 3,700 square miles of the south-eastern tsetse belt were produced. The area between the Sabi and Lundi Rivers mapped in 1958/59, was extended to the north, where some 2,000 square miles of the Sabi Valley and Chipinga District were mapped on a scale of 1:20,000; and to the south, where approximately 1,700 square miles of the South Lundi area (Gonakudzingwa and Matibi II) were mapped on a scale of 1:40,000.

At the time of mapping, it was not possible to produce a complete classification of the vegetation based on Associations. Instead, the vegetation was divided into a number of "groups", such as "Mopane", *Combretum* spp., *Acacia* spp., *Brachystegia tamarindoides,* etc.

On the map, each group was represented by a number, and the growth form, that is, woodland, savanna woodland, thicket, etc., by a letter. The habit, height and density of the vegetation was represented by additional symbols, and the characteristic species present were indicated by initials. This system of symbols enables a considerable amount of information about each vegetation zone to be included on the map.

Following the ground survey of the area, the vegetation zones are marked on the aerial photos, on which the vegetation patterns are readily apparent, and traced on to the map sheets. The maps so produced give a picture of the distribution of vegetation types, and, more important, of tsetse habitat. The areas covered by each type can be measured, and the planning of control operations is greatly simplified.

The complexity of vegetation in the Sabi area is partly due to differences in geology. In the Sabi Valley and Chipinga District, a number of geological zones occur; the alluvial basin of the Sabi; the Umkondo rocks of Chipinga District; the Umkondo of the Sabi west bank; the sandstone; and the basalt.

On the alluvium, a series of associations may be traced from the banks of the Sabi to the Umkondo rocks to east and west.

The river bank supports a fringing forest, with a zone of *Hyphaene crinita* palm woodland inland, which is succeeded by *Acacia tortilis - Lonchocarpus capassa woodland.* These three associations on deep loamy soils form a suitable habitat for *G. pallidipes* and, where they occur on Humani and Devuli Ranches, were sprayed with 3.6 per cent. dieldrin during the insecticide campaign of August-September, 1960.

These associations are succeeded by *A. xanthophloea* parkland on the belt of pans on either side of the Sabi, then *A. tortilis - Euphorbia ingens* savanna woodland, *A. tortilis* parkland and mopane *(Colophospermum mopane)* woodland near the Umkondo contact.

The Umkondo rocks form the Chipinga escarpment, on which a succession of associations can be seen. *Combretum apiculatum* bushland at the lower levels, with some mopane, and *Androstachys johnsoni* thicket in kloofs, is succeeded in turn by *Julbernardia globiflora, Brachystegis tamarindoides,* and *Brachystegia spiciformis* on the crest. This latter species is dominant over wide areas of the Chipinga plateau, with *Uapaca kirkiana* and *Parinari curatellifolia.*

On the west bank, strongly faulted Umkondo rocks occur in the Sangwe Native Reserve. Areas of mopane, *C. apiculatum, Kirkia acuminata* and *B. tamarindoides* occur here, while the Umkondo areas of Devuli Ranch support a mixed savanna woodland of *C. apiculatum, Commiphora mollis* and mopane.

The sandstone belt in the Sabi Valley supports a succession of associations. *B. tamarindoides* occurs on the hills, surrounded by a woodland of *J. globiflora - Pterocarpus angolensis - Terminalia sericea* at lower levels. Outside these woodland areas, a "sandveld" bushland occurs, with *Pteleopsis myrtifolia, Terminalia sericea,* and *C. apiculatum,* and closer to the basalt contact, an association of *Drypetes mossambicense, Strychnos stuhlmannii* and *Spirostachys africana.*

The basalt zone extending from the international border across the Sabi, supports, in its central areas, open grassland, or a shrub savanna of *Combretum ghasalense.* A zone of scrub mopane lies on either side of the Sabi River, with *Acacia nigrescens* parkland further inland. On the east bank, a *Terminalia stenostachys - C. ghasalense* bushland covers the hills near the border, and elsewhere, *C. apiculatum - Pterocarpus brenanii* bushland occurs.

South of the River Lundi three main geological zones occur; the basalt in the north, a westwards extension of the Sabi basalt zone; the granite, and the sandstone to the south.

Much of the basalt between the Lundi River and the railway is covered with low scrub mopane, with some open grassland in the central areas. The granite supports a *Combretum apiculatum* association. On the level area extending to the railway mopane is co-dominant, while on the Sibonjla hills near the Lundi River *Combretum mollis* and *Kirkia acuminata* become important. A westwards extension of the Chiwonja *B. tamarindoides* woodland occurs on the Sibonjlas, farther south.

The sandstone forms a raised plateau to the south of the granite, cut into by the Ramasikana and Guluene river systems. In the valleys, areas of mopane woodland occur, often associated with *Spirostachys africana.* This thins out on the plateau slopes, and is succeeded by open scrub mopane or grassland, with thickets of *S. africana* and *Terminalia prunoides* near the plateau rim. The sandy soils of the plateau support a "sandveld" vegetation over most of its area. The northern areas of the plateau are generally covered with a low scrub savanna of *Diplorhynchus condylocarpon, Terminalia sericea* and *Combretum mossambicense,* with scattered *Pterocarpu angolensis.* In these areas, large zones of *B. tamarindoides* or *J. globiflora* woodland occur. More southerly parts of the plateau, near the international border, support a savanna woodland of *Pteleopsis myrtifolia, C. apiculatum* and *Strychnos innocua,* with scattered *Afzelia cuanzensis* and other large trees. In the central areas of the plateau, zones of *Andrystachys johnsoni* occur. Close to the border, *Guibourtia conjugata* woodland is frequent, and occurs as a dense stand in the Ramasikana basin. Numerous pans occur on the surface of the plateau, and with these are associated zones of *Spirostachys africana* woodland.

The vegetation of the plateau thus takes the form of isolated zones of woodland which form suitable *G. morsitans* habitat, in a matrix of open "sandveld" bush. A barrier zone, to prevent westward expansion of the South Lundi tsetse belt, is being created to the east of the railway by the removal of these woodland zones in a strip ten miles wide and 30 miles long.

The vegetation maps have been used in planning the South Lundi bush clearing scheme, the lower Mkwasine bush clearing, and the Humani-Devuli insecticide operation.

(4) OBSERVATIONS ON HAEMATOPHAGOUS FLIES OTHER THAN TSETSE IN THE SABI AREA

by R. Goodier

It has been demonstrated both in the laboratory and in the field that in certain circumstances *Trypanosoma vivax* and *T. congolense* may be transmitted in the absence of tsetse flies and the possibility of the mechanical transmission of trypanosomiasis by biting flies other than tsetse has frequently been suggested as an explanation for the incidence of trypanosomiasis in cattle in areas where tsetse have not been found. Although many of these instances are more probably due to the presence of the more cryptic species of tsetse such as *Glossina austeni* or *G. pallidipes* there still appears to be a good deal of circumstantial evidence to suggest that biting flies other than tsetse may help to disseminate trypanosomiasis amongst a herd of cattle after it has been introduced into the herd either by tsetse or by movement of cattle into the herd which have acquired their infection from tsetse elsewhere. *Trypanosoma vivax*, the development of which in the tsetse is confined to the proboscis, is known to be permanently transmissable by flies other than tsetse in certain circumstances as the disease caused by this organism occurs in South America in the absence of tsetse.

It was therefore decided to commence an investigation into the biting flies of the Sabi Area in January, 1960, to determine in the first place which species occurred in the area and secondly their seasonal distribution and relative abundance.

As the work is still in progress this report is of a preliminary nature.

SPECIES COMPOSITION OF THE BITING FLY FAUNA

The major part of the work has so far been carried out at Chipinda Pools on the Lundi River at an altitude of about 1,000 ft. above sea level. The biting flies were caught on bait oxen undertaking traverses in the vicinity of the Lundi River.

The haematophagous diptera other than tsetse and Nematocera so far recorded from the Chipinda Pools area are listed as follows—

Tabanidae. In this family only the females take blood.

Chrysopinae.—Hinea lugubris Austen, *Thriambeutes v-album* Surcouf, *Mesomyia decora* Macquart.

Pangoninae.—Philoliche zonata Walker: *Philoliche silverlocki* Austen, *Philoliche medialis* Oldroyd, *Philoliche fodiens* Austen.

Tabaninae.—Ancala africana Gray, *Atylotus agrestis* Wiedemann, *Tabanus leucostomus* Lowe, *T. gratus* Loew, *T. pertinens* Austen, *T. atrimanus* Loew, *T. pullulus* Austen, *T. copemani* Austen, *T. biguttatus* Wiedemann, *T. taeniola* P. de Beaucois, *T. ustus* Walker, *Haematopota vittata* Loew, *H. albihirta* Katsch.

Muscidae. In the Stomoxydinae both the males and females take blood.

Stomoxydinae.—Stomoxys calcitrans L, S. *nigra* Macquart, *S. sitiens* Rond, *Haematobia latifrons* Malloch.

In addition to the species listed above the following were taken in other parts of the Sabi area: *Philoliche rubramarginata* Macquart (Pangoninae), *Euancala maculatissima* Macquart (Tabaninae).

With the exception of *Hinea lugubris* and *Thriambeutes v-album* all the above listed species were observed to take blood from the bait oxen.

SEASONAL DISTRIBUTION

Many Tabanidae are markedly seasonal in their occurrence. The incidence of the more abundant species between January, 1960, and October, 1960, are shown in the table below.

	January	February	March	April	May	June	July	August	September	October
Philoliche medialis	*	*	*	*						
P. silverlocki	*	*	*	*						
P. fodiens			*	*						
P. zonata			*	*	*					
Mesonyia decora								*	*	
Tabanus copemani	*	*	*							
T. gratus		*	*	*	*	*	*	*	*	*
T. pertinens			*	*	*	*	*	*	*	*
T. atrimanus			*	*	*	*		*	*	*
T. biguttatus			*	*	*					*
T. leucostomus										*
T. ustus									*	
Haematopota vittata	*		*	*	*	*		*	*	*
H. albihirta	*	*	*	*	*	*	*	*	*	*
Stomoxydinae	*	*	*	*	*	*	*	*	*	*

Table showing the seasonal incidence of the more common biting flies at Chipinda Pools on the Lundi River.

The Stomoxydinae were present throughout the year although great fluctuations in their availability occurred.

More detailed information on the flight seasons and the availability of the different species will be published later when records are more complete.

DISCUSSION

From the above data it will be noted firstly that the number of haematophagous diptera attracted to bait oxen is large and secondly that there is no time during the year when biting flies are not present.

The relative importance of species of *Philoliche* during the wet season was unexpected. Little is known of the feeding habits of members of this genus but observations suggest that they are less efficient blood feeders than species of *Tabanus* or *Haematopota* as they frequently appear to probe many times before obtaining a full blood meal. This probing, together with the fact that their mouthparts are large suggests that they may, in suitable circumstances, be effective mechanical transmitters of trypanosomes and it is intended to make further studies on the feeding habits of this genus during the 1960/61 wet season.

ACKNOWLEDGEMENTS

I am indebted to Mr. H. Oldroyd of the British Museum (Natural History) for checking most of my identifications of the Tabanidae and to Mr. H. E. Paterson of the South African Institute of Medical Research for identifying the Stomoxydinae.

(5) THE DIURNAL FEEDING ACTIVITY, RESTING SITES AND TRYPANOSOME CHALLENGE OF *G. PALLIDIPES* AT REKOMITJIE

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by B. M. Leggate, *Entomologist*

Investigations into the diurnal feeding activity, resting behaviour and trypanosome challenge of *Glossina pallidipes* were carried out in the evergreen vegetation belt along the Rekomitjie River.

Engorged flies, caught off an ox tethered in the shade of an *Acacia albida*, were recorded, marked and released over the period from just before dawn (0445 hours in November) until just after dusk (1845 hours in November) each day. Each half hour whirling psychrometer, barometric pressure and light intensity readings were made. Systematic searching of the vegetation in the vicinity of the ox (over about one acre) was carried out simultaneously and all marked flies observed resting were recorded. Estimates of the trypanosome infection rates in samples of flies caught in the vicinity of the experimental site were obtained by dissection. Part of this work is to be published shortly (*see* page 228).

The investigation started in November, 1959, was continued throughout the year, the technique being repeated in February, May and August, 1960, on some nine to fourteen days in each month.

Diurnal Feeding Activity. The diurnal feeding patterns exhibited seasonal differences. Characteristic of all four months is the greater activity occurring in the latter part of the day, maximum activity being apparently associated with the period during which or just after which, the diurnal maximum temperature and minimum humidity were reached. At this time also, the light intensity began to decline, a factor which may be of some importance.

The mean numbers of flies caught per day during each period of the investigation are shown in Table I below together with the mean percentage of female flies in the catch.

Table I

THE MEAN CATCH OF *G. PALLIDIPES* PER DAY AND FEMALE PERCENTAGE, 1959/60

Month	*Mean Catch of Flies*	*Number of Females Mean (percentage)*
November	303·0	59·2
February	53·8	67·4
May	226·8	77·6
August	183·0	59·8

The highest total (November) is associated with concentration of fly on the riverine belt and probably also with a shorter hunger cycle. Conversely the low February catch would seem to be due to the dispersal of the tsetse, a need to feed less often at this time of year, and probably also in part to the poor visibility of the stationary ox, all of the vegetation being in full leaf and the grass tall.

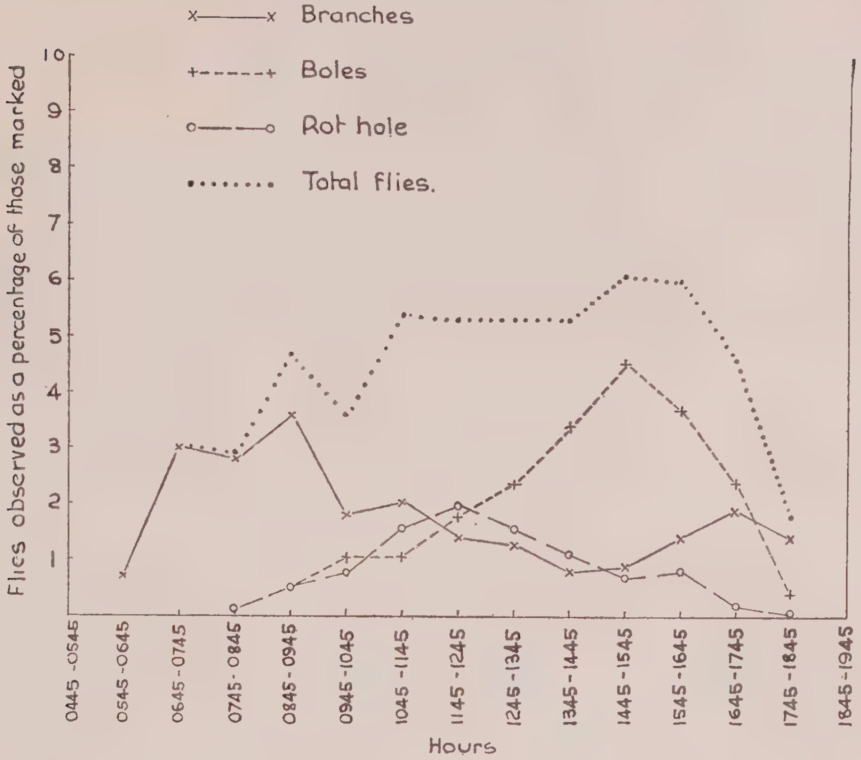
Since males and females are produced in roughly equal numbers, and as female tsetses live longer in nature than males, it might be expected that sampling methods should reveal a slight preponderance of females over males. This is indeed borne out by the results given in Table I above and we may thus assume that a truly representative sample of the population is being obtained.

Resting Behaviour of Fed Flies. The behaviour of flies after feeding was also found to vary with the season and therefore directly or indirectly with changes in vegetation.

At the start of the experiment in November, 1959, when the under-storey trees and shrubs were all leafless and the ground flora absent, the choice of resting positions appeared to vary diurnally between three major types of site (Fig. 1):

1. "Branches" which were generally of small diameter (½ in. to 3 in.) up to 9 ft. above ground level. For the most part they were branches of lower storey trees and shrubs, it being impossible to include the branches of the upper storey trees in the searching area.
2. "Boles" refer to the lower trunks of large trees.
3. The "rot hole" was a single large hole situated about eight feet above ground level in *Kigelia pinnata*.

FIGURE 1.—Resting Sites of *G. pallidipes.*
Late dry season (Oct./Nov./Dec., 1959)



There appeared to be a preference for branches at the start of the day, followed by a shift into the rot hole which showed the greatest number of flies between 1145 and 1245 hours. In the afternoon more flies were found on boles than in other sites, with a peak between 1445 and 1545 hours and finally, just before dark, the number of flies on branches showed an increase.

In February, towards the end of the rains, when the vegetation was in full leaf and the ground flora abundant, resting behaviour was found to have changed. Far fewer flies were marked during this period but the percentage of recaptures was high and flies could be found resting only on branches.

Again in May and August a uniform pattern of resting behaviour was observed and it would appear, therefore, that the utilization by *G. pallidipes* of boles and sites other than branches, is confined to the late dry season.

No detailed investigation has yet been made of the night resting sites of *G. pallidipes,* although a small experiment was conducted in May. 185 flies marked with "Codit" reflecting paint were released at 1800 hours and a search made for them with beam torches between 1930 and 2100 hours. Eight flies were observed, of which six were found on leaves and two on small twigs. This apparent movement of flies on to leaves at night is in line with observations made by Jewell on *G. swynnertoni* and Rennison, Lumsden and Webb (1958—Nature, p. 1354) on *G. pallidipes.*

Trypanosome Challenge. An estimate of the trypanosome challenge (or trypanosome risk as defined by the E.A.T.R.O. Expert Conference on Drug Resistance in Trypanosomes held on the 1st to the 3rd March, 1960) experienced by the ox was obtained by calculating the mean number of infected bites received by the ox per day. The infection rate, as noted above, was estimated as the percentage of flies caught in the vicinity of the experimental site, which were found, on dissection, to be carrying trypanosomes.

Table II shows that this estimate of challenge per day may vary between 3.1 in February and 29.5 in November. If the challenge were calculated as the number of infective bites received per hour, it would, of course, vary diurnally.

TABLE II

SEASONAL "CHALLENGE" RATE IN *G. PALLIDIPES*
AT REKOMITJIE, 1959/60

Month	*Mean non-teneral flies per day*	*Infection rates*	*Mean infective bites per day*
November . . .	289·5	10·3	29·5
February	50·7	6·5	3·3
May	226·8	10·5	23·8
August	178·4	10·8	18·4

(6) TRYPANOSOME INFECTIONS IN *GLOSSINA MORSITANS* AND *G. PALLIDIPES* AT REKOMITJIE

by B. M. LEGGATE, *Entomologist*

The total flies dissected during the year with the infections thus revealed are given in Table I.

TABLE I

TRYPANOSOME INFECTION RATES AT REKOMITJIE

	Number	*Per cent. infected*	*Per cent. proboscis infections*	*Per cent. gut and proboscis infections*	*Per cent. Salivary gland infections*
G. morsitans . .	2,264	20·0	(*a*) 11·6	7·6	0·7
			(*b*) 58·1	38·3	3·7
G. pallidipes . .	2,401	9·5	(*a*) 5·5	2·8	1·1
			(*b*) 58·6	29·9	11·5

(*a*) percentage of all flies examined.
(*b*) percentage of flies positive.

It will be noted that *G. morsitans* shows a gross infection rate a little more than twice that of *G. pallidipes.* Roughly the same proportion of infections of the proboscis only (presumably *T. vivax*) occur in both species of tsetse flies. The gut and proboscis infections (presumably largely *T. congolense)* form a somewhat smaller proportion of the *pallidipes* infections, but as noted in this tsetse elsewhere salivary gland infections *(T. brucei)* are relatively high.

Since June, 1960, infection rates have been recorded separately from four different collecting sites.

TABLE II

GROSS INFECTION RATES IN *G. morsitans* AND *G. pallidipes* FROM DIFFERENT COLLECTING SITES AT REKOMITJIE

A. *G. morsitans*

	Infection Rates (percentage)			
Site	*June*	*July*	*August*	*September*
1. Evergreen vegetation on alluvium . .	25·6	26·0	33·0	36·5
2. Mopane-thicket contact	18·6	16·8	25·0	18·0
3. Evergreen drainage line vegetation . .	11·9	20·0	19·5	20·3
4. Mopane woodland	17·6	13·3	11·0	10·6

B. *G. pallidipes*

Site	*June*	*July*	*August*	*September*
1. Evergreen vegetation on alluvium . .	9·5	12·6	10·3	9·0
2. Mopane-thicket contact	12·0	16·0	12·5	6·1
3. Evergreen drainage line thicket . . .	7·6	7·9	10·0	5·0

It will be noted in Table II that infection rates, both in *G. morsitans* and in *G. pallidipes* have varied appreciably with the passage of time and there is a strong suggestion that infection rates vary with the site at which flies were caught. The study is continuing.

(7) THE CROSSING OF THE SEBUNGWE GAME FREE BARRIER BY *G. MORSITANS*

by R. D. Pilson, *Survey Ecologist*

From the 1st to 24th May, 1960, a small experiment was carried out to determine whether or not tsetse flies were crossing the 10 mile zone between the game and cattle fences on the north and south sides respectively of the game destruction area in Binga District. On each of two roads leading from the Siambola Gate, 20 stations were set up at half-mile intervals, at which tsetse flies, attracted to a Land-Rover, were caught, marked and released. These two roads were:

(a) that along the game fence running east from Siambola, and

(b) the Siambola-Cewali road, which crosses the gap between the fences diagonally in a south-easterly direction.

On a third road, the Dongamusi track leading due south from Siambola, 10 stations also at half-mile intervals were used for capture of tsetse only (Map I).

During the 24 days of the experiment 1,467 flies were marked and of these 31 were recaptured. Only six flies were recaptured at the station at which they were marked and, curiously, all were marked on the 17th and recaptured on the 18th May. The somewhat unexpectedly high degree of movement (apart from these six flies) is, perhaps, an effect of the relative absence of game. The average distance travelled by recaptured flies was 5.1 miles and the average time between marking and recapture was 63 hours 45 minutes. A majority of recaptures (17) were made at the Siambola Gate indicating, as was expected, that the movements recorded were mainly by carriage on road traffic. Five flies were marked on the game fence and recaptured on the Cewali Road. These, if carried by traffic, had escaped capture at the Siambola Gate: more probably they had moved by other means (flight or game carriage) through the bush. One fly marked on the Cewali Road was recaptured at the Mzola Gate having moved 20 miles in less than one day, presumably by road traffic. Another recaptured at Mzola Camp had travelled at least 25 miles in 13 days. One fly only was recaptured on the Dongamusi Track but within the Dongamusi Basin.

Although only on a small scale this experiment showed that *G. morsitans* does cross the defence zone and also that flies originating in the Nagupande drainage system can cross the *Brachystegia-Baikiaea* woodlands of the watershed between it and the Mzola-Dongamusi basin.

(8) BLOOD-MEALS OF *G. MORSITANS* IN SEBUNGWE

by R. D. Pilson, *Survey Ecologist*

Two collections of blood-meals of *G. morsitans* were analysed, by kindness of Mr. B. Weitz, at the Lister Institute of Preventive Medicine. The smaller came from the game destruction area in the neighbourhood of the watershed between the Nagupande and Dongamusi Rivers: the larger from the Maseme River area later subjected to insecticide spraying.

Source of feed	No. of *G. morsitans* blood meals *Nagupande-Dongamusi*		*Maseme*	
Primates —				
Man	1		1	
Baboon	—		1	
Unidentified	1		—	
TOTALS	2	(4·4%)	2	(1·4%)
Bividae —				
Ox	—		19	
Buffalo	—		2	
Kudu	11		10	
Reedbuck	—		12	
Eland	—		6	
Roan	1		—	
Ox or kudu	—		1	
Eland or kudu	—		2	
Unidentified	8		19	
TOTALS	20	(44·4%)	71	(47·9%)
Suidae —				
Wart-hog	6		49	
Bushpig	4		1	
Unidentified	11		15	
TOTALS	21	(46·7%)	65	(43·9%)
Other Mammals —				
Dog	—		1	(0·7%)
Birds	2	(4·4%)	9	(6·1%)
TOTALS	45	(100·0%)	148	(100·0%)

The absence of small buck (duiker, steenbok, grysbok) from the Nagupande-Dongamusi collection provided one of the reasons for the decision to close the game destruction campaign. It was expected that the change in the mammal fauna brought about by shooting would have reflected itself in the feeding habits of the tsetse; but it is evident (although the sample is a small one) that the basic feeding pattern, in which pigs predominate, with the larger Bovidae forming the second largest group, is still retained.

The high proportion of ox feeds in the Maseme collection (from an area where there has been no hunting for some years) is due to the use of bait oxen on flyrounds. Removal of these 19 ox feeds from this collection alters the proportion of Bovid and Suid feeds to 40.3 and 50.4 per cent. respectively. The present data may be compared with the results from a somewhat larger collection from a nearby area, by Mr. Lovemore, published in the Annual Report for 1956-57. The main difference is that in the latter, primates and other animals formed 22.1 per cent. of the collection as opposed to 2.1 per cent. in the Maseme collection.

Appendix 1

GAME DESTRUCTION

Larger Game	
Elephant	12
Zebra	29
Buffalo	36
Tsessebe	9
Waterbuck	30
Reedbuck	230
Sable	202
Roan	37
Eland	29
Kudu	681
Bushbuck	804
Nyala	48
Impala	262
TOTAL	2,409

TOTAL

Smaller Game and Carnivores	
Duiker	8,524
Oribi	24
Steenbok	729
Sharpe's Grysbok	1,243
Bushpig	1,286
Wart-hog	1,583
Klipspringer	161
Suni	9
Ant-bear	2
Genet	2
Porcupine	1
Civet	4
Baboon	1,921
Wild dog	26
Hyaena	14
Leopard	5
Lion	1
TOTAL	15,535

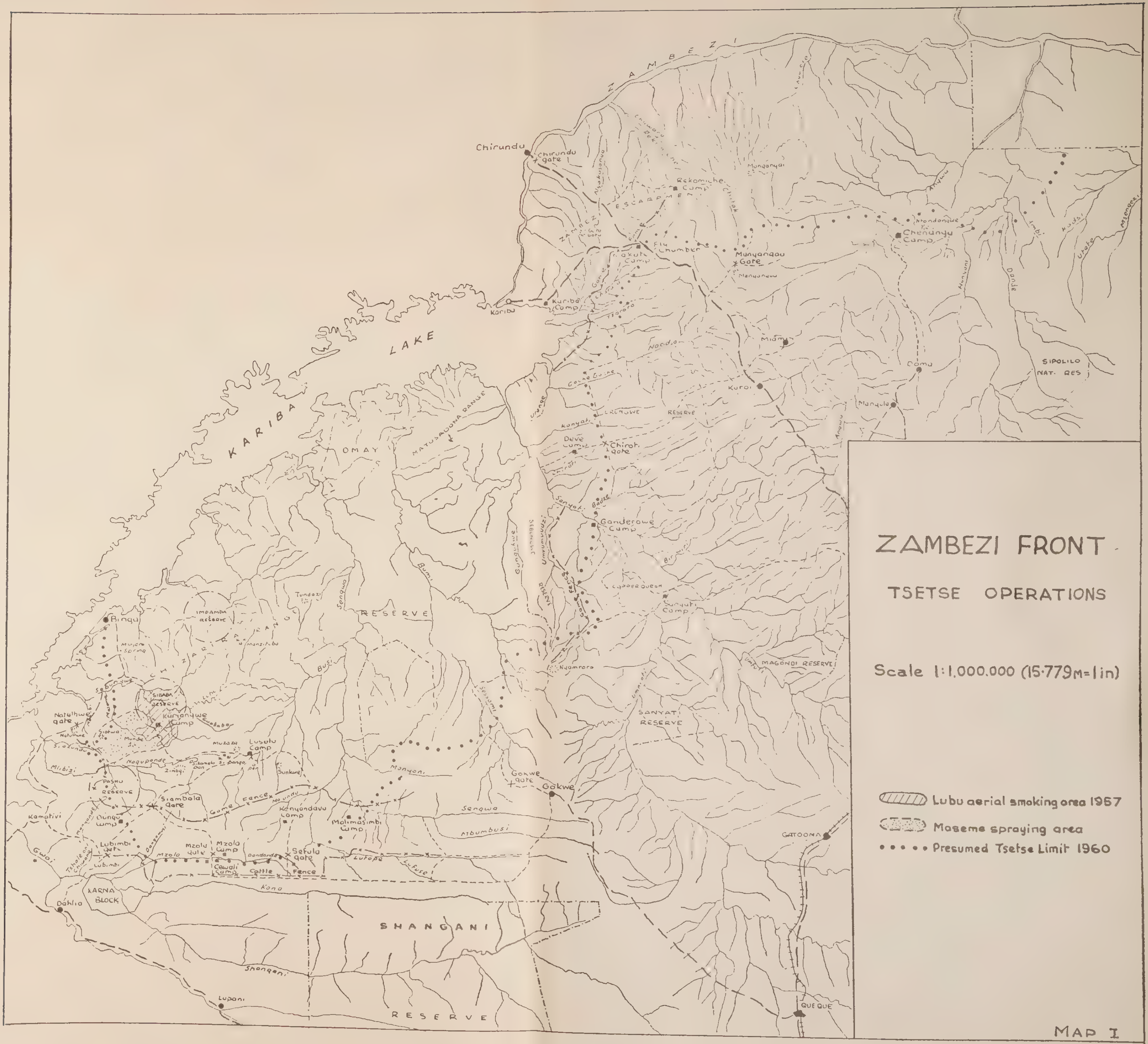
Larger Game	2,409	(13·4%)
Smaller Game	15,535	(86·6%)
TOTAL	17,944	

TRAFFIC CONTROL RETURNS — 1959/60

District	Sp.	Cars				Cycles				Pedestrians			
		No .	M	F	Total	No.	M	F	Total	No.	M	F	Total
North Urungwe . .	*m*	124,396	153	133	286	14,525	79	83	162	14,118	71	68	139
	p		2	3	5		2	6	8		2	1	3
Urungwe Native Reserve	*m*	940	—	1	1	2,662	2	6	8	2,357	—	—	—
Mtoko	*m*	21,064	42	33	75	4,927	4	8	12	8,194	10	4	14
Sabi East	*m*	387	1	—	1	10,233	646	373	1,019	77,889	1,013	694	1,707
	p		—	—	—		15	23	38		93	85	178
Sabi West	*m*	241	2	—	2	3,385	14	13	27	5,477	2	3	5
South Lundi	*m*	1,106	5	—	5	2,842	—	1	1	7,486	4	2	6
Chipinga	*p*	—	—	—	—	—	—	—	—	2,947	—	2	2
	b		—	—	—		—	—	—		2	1	3
Sebungwe	*m*	5,816	394	242	636	9,291	2,787	1,088	3,875	13,005	277	120	397
	p		—	—	—		—	—	—		—	—	—
TOTAL . .	*m*	153,950	597	409	1,006	47,865	3,532	1,572	5,104	131,473	1,377	891	2,268
	p		2	3	5		17	29	46		95	88	183
	b		—	—	—		—	—	—		2	1	3

m *Glossina morsitans*
p *G. pallidipes*
b *G. brevipalpis*

Flies per 100 cars . . . . . 0·65
Flies per 100 cycles . . . . 10·7
Flies per 100 foot . . . . . 1·7


ZAMBEZI
LAKE
KARIBA
Chirundu
Chirundu gate
Rekomiche Camp
ESCARPMENT
Mungangwi
Chenungu Camp
Flu Chumber
Munyangau Gate
Nakuti Camp
Kariba
Kariba Camp
Tigroro
Miami
Kuroi
Dom
Manyula
SIPOLILO NAT. RES
Gowe
Konyati
URUNGWE
RESERVE
Deve Camp
Chirot. gate
Gandarowe Camp
Sanyati
Sanyati Camp
Ngamrora
SANYATI RESERVE
MAGONDI RESERVE
Gokwe gate
Gokwe
Sengwa
Mbumbusi
GATOONA
QUE QUE
OMAY
MATUSADONA RANGE
Bumi
RESERVE
Tundazi
Senqwa
Busi
IMBAMBA RESERVE
Binga
CHIZARIRA RANGE
SIBABA RESERVE
Kurunywe Camp
Natulhwe gate
Lusulu Camp
Siambola gate
Game Fence
Kenyandavu Camp
Malimasimbi Camp
Manyani
Mzola gate
Mzola Camp
Sefula gate
Cewali Camp
Cattle Fence
Lutope
Lubimbi gate
Lubimbi
Dungu Camp
Kamativi
Gwai
Dahlia
KARNA BLOCK
Kana
SHANGANI
Shangani
Lupani
RESERVE

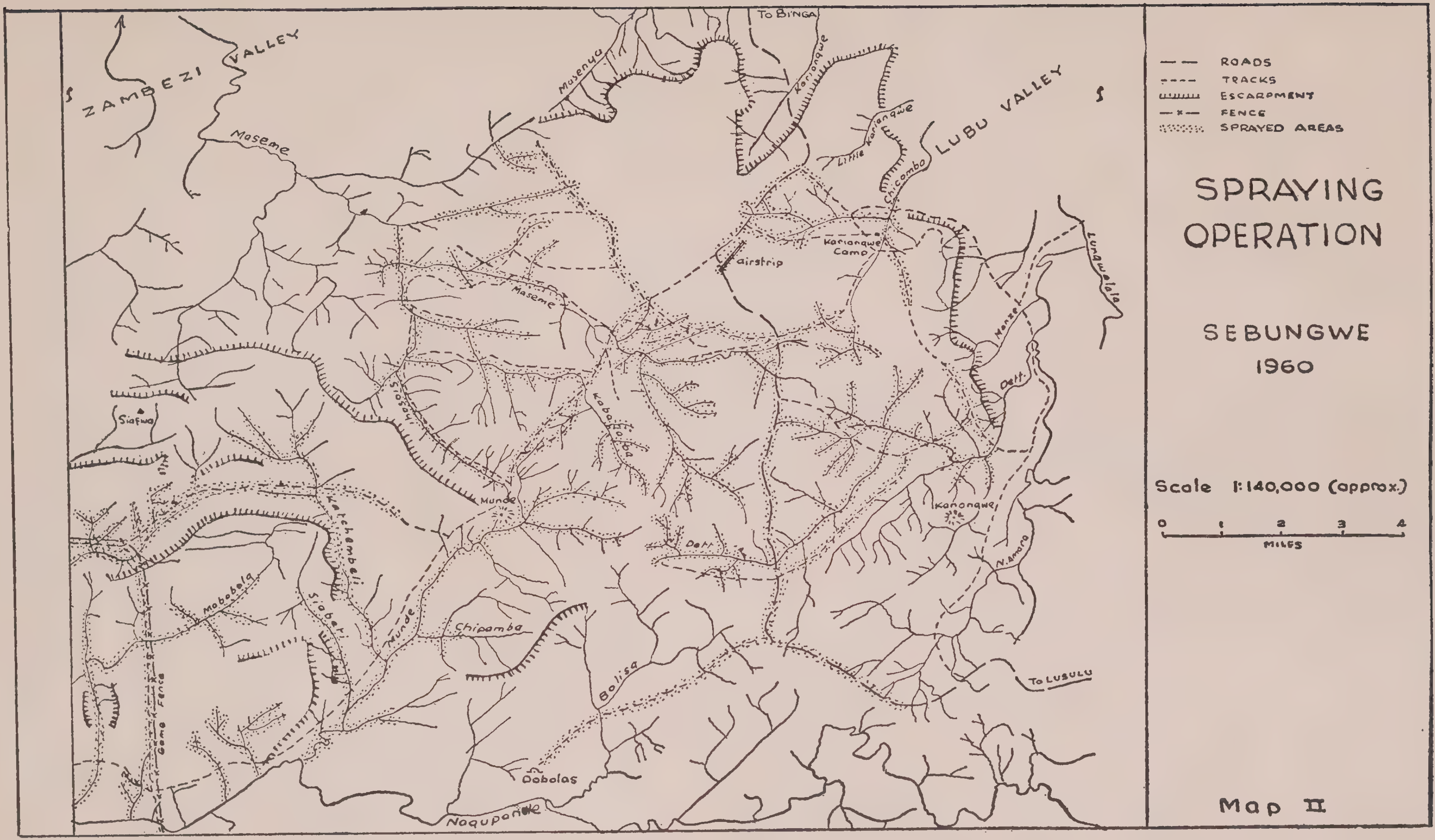
ZAMBEZI FRONT.

TSETSE OPERATIONS

Scale 1:1,000,000 (15·779m=1in)

▨	Lubu aerial smoking area 1957
░	Maseme spraying area
• • • • •	Presumed Tsetse Limit 1960

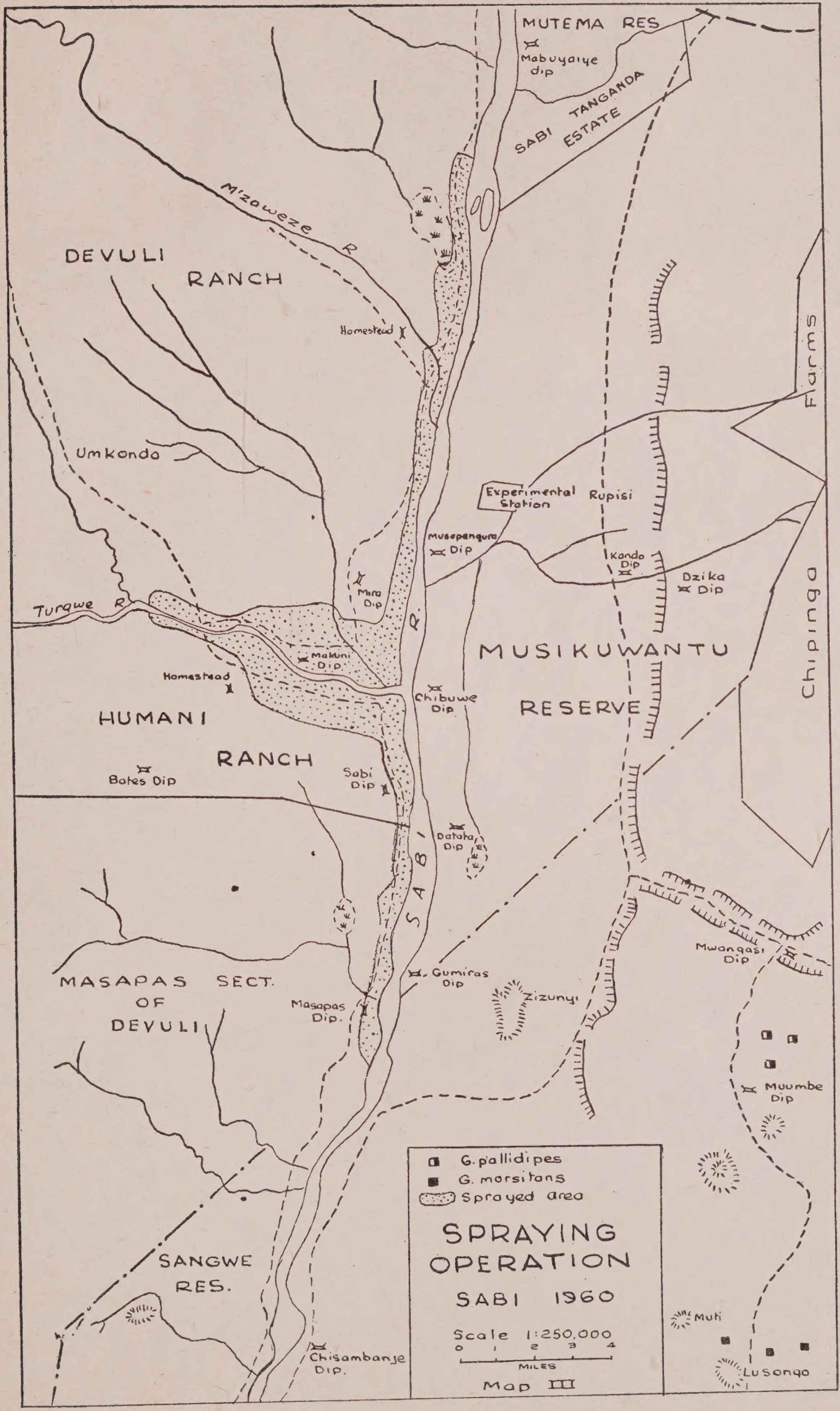
MAP I


ZAMBEZI VALLEY
Maseme
Musenya
To BINGA
Karianqwe
Little Karianqwe
Chicombo
LUBU VALLEY
Lungwalala
Karianqwe Camp
airstrip
Maseme
Manze
Dett
Siafwa
Siosoy
Kabakaba
Munde
Katchembeli
Kanonqwe
Dett
N. Amara
Mabobela
Siabeti
Munde
Chipamba
Gomo Fence
Bolisa
To LUSULU
Dobolas
Noquponde
ROADS
TRACKS
ESCARPMENT
FENCE
SPRAYED AREAS
Scale 1:140,000 (approx.)
0
1
2
3
4
MILES

SPRAYING OPERATION

SEBUNGWE
1960

Map II


MUTEMA RES
Mabuyaiye dip
SABI TANGANDA ESTATE
M'zaweze R
DEVULI RANCH
Homestead
Umkondo
Experimental Station
Rupisi
Musepengura Dip
Kondo Dip
Dzika Dip
Mira Dip
Turgwe R
Makuni Dip
Homestead
MUSIKUWANTU RESERVE
Chibuwe Dip
HUMANI RANCH
Bates Dip
Sabi Dip
SABI R.
Datata Dip
Farms
Chipinga
Mwangasi Dip
Gumiras Dip
Zizunyi
MASAPAS SECT. OF DEVULI
Masapas Dip.
Muumbe Dip
SANGWE RES.
Chisambanje Dip.
Muti
Lusongo
▫ G. pallidipes
■ G. morsitans
Sprayed area
SPRAYING OPERATION
SABI 1960
Scale 1:250,000
0 1 2 3 4
MILES
Map III